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Sport Fishery Abstracts

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Sport Fishery Abstracts

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Sport Fishery Abstracts is intended to furnish fishery biologists in government agencies and educational institutions with abstracts of the current literature in sport fishery research and management. Abstracts of papers on limnology, ecology, natural history and other fields of specialization will be included when the subject has application to the conservation of sport fish and the restoration of sport fishing.

One volume consisting of not more than four numbers will be issued each year. Each number contains separate Author and Subject indexes, with the final number of each volume containing cumulative indexes. The last number of each volume contains a list of publications screened for appropriate material.

Suggestions for improving the usefulness and coverage of Sport Fishery Abstracts are solicited.

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Prepared in the Branch of Federal Aid
M. A. Marston, Chief
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6033. Tebo, L. B., Jr. (Water Quality Section, U. S. Public Health Service, Cincinnati, Ohio), and W. W. Hassler. 1963. FOOD OF BROOK, BROWN, AND RAINBOW TROUT FROM STREAMS IN WESTERN NORTH CAROLINA. The Journal of the Elisha Mitchell Scientific Society, Vol. 79, No. 1, pp. 44-53.

The food of brook, brown, and rainbow trout collected from streams of western North Carolina varied considerably, especially in the proportion of surface and subsurface foods eaten. For the summer period, rainbow trout took the major part of their food under water, while the brook and brown trout consumed slightly smaller amounts.

The brown trout was the most frequent surface feeder, taking 54.1 percent of their food from the surface, while brook and rainbow took 51.6 and 41.0 percent of their food from the surface.

The brown trout fed to a greater extent on vertebrates, crayfish, and snails than the other two species.

All three species of trout took larger numbers of caddis flies than any other order of immature aquatic insects.

The only exception to availability as the most important determining factor is the tendency for larger trout to select the larger organisms available in the habitat. (Authors)

6034. Kobayashi, Hideshi, Haruko Uemura, Yoshihiko Oota, and Susumu Ishii (Zoological Inst., Faculty of Science, Univ. of Tokyo, Tokyo, Japan). 1963. CHOLINERGIC SUBSTANCE IN THE CAUDAL NEUROSECRETORY STORAGE ORGAN OF FISH. Science, Vol. 141, No. 3582, pp. 714-715.

Cholinergic substance exists in homogenates of caudal neurosecretory storage organs of fish. The caudal organs of fresh-water fish contain about 10 times the amount found in caudal organs of marine fish. The substance in the caudal organ of the carp is more than 100 times as concentrated as that in the brain. (Authors)

6035. Burmakin, E. V. 1961. SOME ASPECTS OF THE THEORY OF ACCLIMATIZATION OF FRESH-WATER FISH. (NEKOTORYE VOPROSY TEORII AKKLIMATIZATSII PRESNOVODNYKH RYB.) Zool. Zhur. 40(9): 1385-1394; Referat. Zhur., Biol., 1962, No. 7136; Biological Abstracts, Vol. 42, No. 5, Abst. No. 16548. 1963.

Effectiveness of acclimatization depends on the population pressure of the native species and the ability of the transplanted species to live under a wide variety of conditions. Preditoriness--eating eggs, larval stages and relatively well-grown forms--is the deciding point in the struggle between native and transplanted animals. The acclimatization of fish of poor adaptive flexibility has little chance for success in the face of strongly aboriginal population pressure. Fish with good flexibility of adaptation will acclimatize despite strong native-fish pressure (sunfish and American bullheads in waters of western Europe; bream in the USSR). Species with weak adaptive flexibility will acclimatize when there is little pressure from native fishes. Very good results were obtained in acclimatization of forms with good adaptive flexibility where the native fish pressure is low. Favorable results were obtained in acclimatization of fish with either high or low levels of adaptive flexibility in the absence of aboriginal pressure. Success of acclimatization is most likely if the fish are transplanted beyond barriers insurmountable for the species in question or when preparatory work is carried out to change the natural characteristics of the fish, or of the reservoir into which they are to be transplanted. The importance of transplants to the rate of population growth decreases with the passage of time. The population is controlled only by the environmental conditions and the ecologic flexibility levels of the transplanted fish.

6036. Shulyak, G. S. 1962. DEVELOPMENTAL FEATURES OF ATYPICAL INTESTINES IN THE CARP. (OSOBL'YVOSTI ROZVITKU ATYPYCHNYKH KYSHECHNYKIV KOROPA.) Dopovidi Akad. Nauk. Ukrain. RSR 1. 124-127; Referat. Zhur., Biol., 1962, No. 21I15; Biological Abstracts, Vol. 42, No. 5, Abst. No. 16906. 1963.

The development of loops and the general morphogenesis of the intestines during the early postembryonic period were studied in carp. Four stages of development in the larval period and two stages in the fingerling period were distinguished. The formation of atypical intestines stems from disturbance of the normal process of loop formation, chiefly during the third larval and first post-larval stages of development. When seedings are six to eight times denser, and when culturing in high concentrations (up to 10 larvae per liter of water), young having simplified two-looped intestines are produced. This evidence indicates the existence of a critical period in the development of carp during which optimal conditions for existence are necessary.

6037. Persov, G. M. 1960. CHARACTERISTICS OF THE EARLY GROWTH PERIOD OF REPRODUCTIVE GLANDS IN ONCORHYNCHUS GORBUSCHA IN CONNECTION WITH ITS UTILIZATION AS AN ITEM IN ACCLIMATIZATION. (KHARAKTERISTIKA RANNEGO PERIODA RAZVITIYA POLEVYKH ZHELEZ GORBUSHI V SVYAZI S ISPOL'ZOVANIEM EE KAK OB"EKTA AKKLIMATIZATSII.) Rybnoe Khoz., Moscow. 86-92; Referat. Zhur., Biol., 1962, No. 17I9; Biological Abstracts, Vol. 42, No. 5, Abst. No. 18196. 1963.

Histological studies are made of the growth of gonads (G) in Oncorhynchus gorbuscha (OG) in connection with their acclimatization in the Barents Sea. The difference is that during embryonic growth not only are G established but the process of sex differentiation occurred. From the time of downstream migration to about 2 months of age, the ovaries are in the second stage of puberty. All of the examined embryos and larvae developed in the direction of females. The discovery of males at later stages led to the supposition that they

became so because of cross-determination of sex. In the laboratory, the process of G development was in general agreement with the research of pisciculture plants in southern Sakhalin. It is noted that all of the summer's catches in the Kole River in the Murmansk oblast of OG (6 spec.) were males.

6038. Jones, Robert S., William F. Hettler, and Clark Hubbs (Univ. of Texas, Austin). 1962. EFFECTS OF MATERNAL DEATH ON SURVIVAL OF FERTILIZED EGGS OF THE FISH ETHEOSTOMA SPECTABILE. Texas Jour. Sci. 14(3): 319-322; Biological Abstracts, Vol. 42, No. 5, Abst. No. 18232. 1963.

Fertilized eggs of the orangethroat darter, Etheostoma spectabile, have a reduced survival if they are held three or more hours inside their dead mothers before fertilization. Similar results are obtained in five series of experiments using both homospecific and heterospecific sperm. (Authors)

6039. Vernick, Sanford Herbert. 1962. THE EFFECTS OF TEMPERATURE, LIGHT AND HIGH FREQUENCY RADIO WAVES UPON THE EMBRYONIC DEVELOPMENT OF TILAPIA MACROCEPHALA (BLEEKER). Dissert. Absts. 23(4): 1174-1175; Biological Abstracts, Vol. 42, No. 5, Abst. No. 18251. 1963.

Microcephaly and macrocephaly, vertebral column deformations, and length of time of embryonic development are associated with temperature changes. Tilapia embryos are sensitive to the red end of the spectrum. The 5% which survived the high frequency experiments came from the group which was exposed to 3730 Kc. for 30 minutes in the hatching stage and no abnormality was apparent. (Auth.)

6040. Reynolds, Tom D. (Univ. of Texas, Austin). 1962. POLLUTION EFFECTS OF AGRICULTURAL INSECTICIDES AND SYNTHETIC DETERGENTS. Proc. Texas Water Sewage Works Short Sch. 44: 137; Biological Abstracts, Vol. 42, No. 5, Abst. No. 18833. 1963.

Insecticide pollution of water supplies may be detected by use of goldfish in flow-through tanks. The validity of this test to indicate public health hazards has not been established. Detergents may cause foaming, taste and odor problem, difficulties in coagulation and settling, destruction of certain forms of aquatic life, and an increased P content of streams. The alkylbenzene sulfonate surfactants are of most concern due to their high resistance to biologic decomposition. (G. E.)

6041. Bullock, Wilbur L. (Zool. Dept., Univ. New Hampshire, Durham). 1963. NEOECHINORHYNCHUS PROLIXOIDES N. SP. (ACANTHOCEPHALA) FROM NORTH AMERICAN FISHES. Proc. Helminthol. Soc. Washington 30(1): 92-96; Biological Abstracts, Vol. 42, No. 5, Abst. No. 19835. 1963.

Neoechinorhynchus prolixoides is described from 2 spp. of catostomid fishes from New Hampshire. This new sp. is unique among North American neoechinorhynchids in that the basin circle of proboscis hooks is larger than the middle circle. Additional details are given on the morphology of the closely related N. prolixus. (Auth.)

6042. Outten, L. M. (Mars Hill Coll., Mars Hill, North Carolina). 1962. SOME OBSERVATIONS ON THE SPAWNING COLORATION AND BEHAVIOR OF NOTROPIS LEUCIODUS. Jour. Elisha Mitchell Sci. Soc. 78(2): 101-102; Biological Abstracts, Vol 42, No. 5, Abst. No. 19967. 1963.

6043. Weatherley, A. H. (Australian Natl. Univ., Canberra, Australia). 1963. NOTIONS OF NICHE AND COMPETITION AMONG ANIMALS, WITH SPECIAL REFERENCE TO FRESH-WATER FISH. Nature 197(5862): 14-17; Biological Abstracts, Vol. 42, No. 6, Abst. No. 20471. 1963.

Various definitions of "niche" are reviewed and the following one proposed: the niche is the nutritional role of the animal in its ecosystem, i. e., its relations to all the foods available to it. Evidence in support of the niche is presented using the fish as an example.

6044. Saito, Kaname. 1957. BIOCHEMICAL STUDIES ON THE FISH BLOOD. VIII. ON THE ELECTROPHORETIC SPECIFICITY OF SERUM PROTEINS. Bulletin of the Japanese Society of Scientific Fisheries, Vol. 22, No. 12, pp. 752-759.

By examining the electrophoretic patterns of some fish serum protein obtained under almost the same conditions, the author ascertained the fact that specificity, in quantity as well as in quality, of the serum protein composition conspicuously corresponded, in varying degrees, to the classification of species or to their habitual environment.

In cases of fresh-water teleosts, such as, Cyprinus carpio and Carassius auratus, component I which might correspond, in its mobility, to the human serum albumin is richest among the serum proteins, while in cases of marine teleosts, Chrysophrys major, Trachurus japonicus, Decapterus muroadsi, Coryphaena hippurus, Scomber tapeinocephalus, Thunnus thynnus, the presence of component-f, with a higher mobility than albumin, is apparent, in addition to component I. Component-f is apt to appear more abundantly among the serum proteins.

On the other hand, in the serum proteins of marine elasmobranchs, Squalus mitsukurii, Mustelus griseus, there is no detectable amount of component I to say nothing of component-f, but the compenents II and IV + IV', which may correspond to the human serum globulins, are contained in comparatively large amounts.

Generally, in cases of teleosts, concentration of the component, which corresponds to the r-globulin of human serum, is far less than the control serum (human and rabbit), but in cases of shark serum an extraordinarily high concentration

of this fraction is found.

The albumin globulin ratio of serum protein in cases of marine teleosts is higher than that of the control serum. By using the salt fractionation method it was ascertained that the mackerel serum protein was composed mostly of the albumin fraction, while in the shark's most of them were composed of globulin fractions.

Use of the refractometry as the measuring means of shark serum protein concentration has proven to be inadequate. (Auth.)

6045. Saito, Kaname. 1957. BIOCHEMICAL STUDIES ON FISH BLOOD. IX. ON THE PAPER ELECTROPHORETIC ANALYSIS OF SERUM PROTEINS. Bulletin of the Japanese Society of Scientific Fisheries, Vol. 22, No. 12, pp. 760-767.

In the paper electrophoretic analysis of serum proteins of fish, it was found very important to select the kind of buffer solution, its pH and ionic strength.

The existence of such characteristics of serum protein composition as reported in the former paper was again ascertained. Moreover, in the serum of both shark and skate, existence of the component invested with less mobility than that of r globulin contained in the hyman serum was also ascertained.

As a result of applying paper electrophoresis both to the shark serum containing large amounts of nonprotein nitrogen compounds and to its dialyzed one, it was ascertained that, from a qualitative analytical point of view, even in the case of the original serum, the influences of coexisting nonprotein substances might safely be put out of consideration.

Tiselius method was found to be more effective for separating each component protein than the paper electrophoresis. Under ordinary conditions, paper electrophoresis gives a high value (relative proportion of component) to the fraction of low mobility and a lower value to the fraction with high mobility than those obtained by Tiselius method. (Auth.)

6046. Saito, Kaname. 1957. BIOCHEMICAL STUDIES ON FISH BLOOD. X. ON THE SEASONAL VARIATION OF SERUM PROTEIN COMPONENTS OF CULTURED FISH. Bulletin of the Japanese Society of Scientific Fisheries, Vol. 22, No. 12, pp. 768-772.

By examining the seasonal variation in serum protein composition of cultured mackerel, Scomber tapeinocephalus, and carp, Cyprinus carpio, it was ascertained that the concentration of total protein and albumin fraction in serum showed lower values in February than in May or June, when the feeding behavior reached a climax.

Using blood samples of cultured and natural mackerel (caught in April and June, respectively), hemoglobin content, hematocrit value and concentration of albumin fraction in serum were estimated, and the natural mackerel generally showed higher values than the cultured mackerel. (Auth.)

6047. Saito, Kaname. 1956. BIOCHEMICAL STUDIES ON FISH BLOOD. XII. ON THE DIFFERENCE IN THE CRYSTALLINE TYPE OF HEMOCHROMOGEN AND CHLOROHEMIN BY SPECIES. Bulletin of the Japanese Society of Scientific Fisheries, Vol. 22, No. 12, pp. 160-164.

After preparing, under a fixed condition, some crystals of Hemochromogen and Chlorohemin from humans, domesticated rabbits, hens and fishes blood, the author examined whether the types of crystals showed any difference in accordance with the varying status in zoological classification of those organisms.

The following results were obtained:

As to the types of crystals of Hemochromogen observed under microscope, no intrinsic difference was observed, even in cases of animals with a considerably remote relationship in the zoological classification; e. g. between fishes and humans, to say nothing of the cases within the various kinds of fishes. Consequently, it is not possible to infer the kind of animal by relying only upon the types of crystals.

As to the crystal types of Chlorohemin, in cases of fishes no definite difference was discerned between any two kinds, but in cases of comparative research on the difference between humans and fishes, generally, the crystals prepared from fishes were observed to show far more advanced emerging frequency of the spindle-shaped types than those prepared from human blood.

Accordingly, this feature in the types of crystals may be regarded as an index for discrimination of these two different kinds of organisms. (Auth.)

6048. Flerov, B. A. 1962. OLFACTION IN FISH: A SURVEY OF THE LITERATURE. Trans. of Voprosy Ikhtiologii (USSR), No. 3(24): p. 517-529; Technical Translations, Dept. of Commerce, Vol. 10, No. 2, p. 153. 1963.

The study of the role played by olfaction in a fish's life began with the clarification of whether a fish smells food. After it has been established that fish do have a sense of smell, a number of investigations were made which permitted the conclusion that for many species of fish, odor is the deciding factor in the search for food. So far, attempts to isolate compounds which attract fish have not met with success. In the study of olfaction in the life of fish, an important role has been played by the method of conditioned reflexes. It has been established that some chemical substances are perceived in insignificant amounts by fish. The ability to distinguish between the odors of certain aquatic plants has been shown in Hyborhynchus notatus; in Phoxinus the ability to differentiate accurately the odor not only of specimens of other families, but also the smells of specimens from their own family. Repellents were found for some nonaggressive fish (Phoxinus, salmons). The Phoxinus were repelled by purino- and pterino-like substances isolated from their own skin; salmon

were frightened by α-serine, isolated from the skin of mammals. Recently begun investigations into the role of olfaction in the movement of fish show that the olfactory organ in salmon, eels and certain species of perch plays a decisive role in orientation. (Auth.)

6049. Menzel, D. W., E. M. Hulburt, and J. H. Ryther (Woods Hole Oceanographic Inst., Woods Hole, Massachusetts). 1963. THE EFFECTS OF ENRICHING SARGASSO SEA WATER ON THE PRODUCTION AND SPECIES COMPOSITION OF THE PHYTOPLANKTON. Deep-Sea Research, Vol. 10, No. 3, pp. 209-219.

The technique of artificial enrichment of sea water has been used in an attempt to define nutrients critically limiting the growth of phytoplankton in the Sargasso Sea. It is shown that final population growth achieved with different enrichment is a function of time. In 3-day experiments, iron appeared essential while in 7-day experiments nitrogen and phosphorus alone produced large populations. It is postulated that the influence of iron may be catalytic since enrichment with aluminium produced identical growth curves. In addition, the final population resulting from enrichment in terms of species composition was shown to be a function of the addition of specific nutrients. (Authors)

6050. Kobayasi, Hiromu (Biol. Lab., Asahigawa Coll., Hokkaido Gakugei Daigaku, Asahigawa, Hokkaido, Japan). 1963. SOME CYTOLOGICAL ASPECTS OF FERTILIZATION IN THE CROSS BETWEEN THE FUNA (CARASSIUS CARASSIUS, CYPRINIDAE) AND THE LOACH (MISGURNUS ANGUILLICAUDATUS, COBITIDAE). The Biological Bulletin, Vol. 125, No. 1, pp. 114-124.

Insemination and early cleavages were cytologically investigated in the cross between the funa (Carassius carassius) and the loach (Misgurnus anguillicaudatus), belonging to different families. Eggs of the funa were artificially inseminated with loach sperm at water temperatures from 26° C to 28° C.

Monospermic insemination was cytologically proven; a single spermatozoon of the loach entered the funa egg through the micropyle. Following insemination, the second maturation division of the egg proceeded. About 15 minutes after insemination, the extrusion of the second polocyte occurred. Then the formation of female and male pronuclei followed. About 20 to 25 minutes after insemination, the meeting of the male and female pronuclei took place. In conjugation, both pronuclei came into close contact, side by side, with the nuclear membrane intact, without evidence of actual fusion.

It was difficult to distinguish clearly groups of chromosomes of paternal and maternal origin or to count the chromosome number in the first cleavage metaphase. During the period from anaphase to telophase, separation of the chromosomes took place synchronously, without evidence of lag or elimination of chromosomes. The first cleavage was completed 35 to 40 minutes after insemination.

Early cleavages took place at intervals of 15 to 20 minutes after insemination. No abnormality was detected in the cleavage spindle. The second polar body was found lying in its original position at the first cleavage.

There is no cytological evidence in this cross to show that the sperm acted as a parthenogenetic agent, in spite of the maternal characters noted in larvae resulting from this cross. (Auth.)

6051. Putz, Robert E., and Glenn L. Hoffman (Bur. Sport Fish. and Wildl., Kearneysville, West Virginia). 1963. TWO NEW GYRODACTYLUS (TREMATODA: MONOGENEA) FROM CYPRINID FISHES WITH SYNOPSIS OF THOSE FOUND ON NORTH AMERICAN FISHES. The Journal of Parasitology, Vol. 49, No. 4, pp. 559-566.

Gyrodactylus atratuli from the blacknose dace (Rhinichthys atratulus) and the pearl dace (Semotilus margarita) is compared with known species of Gyrodactylus from North American fishes and described as a new species.

Gyrodactylus margaritae from the pearl dace (Semotilus margarita) is compared with known species of Gyrodactylus from North American fishes and described as a new species.

The average number of G. atratuli per blacknose dace in the natural habitat is 7.8 (1 to 32) and in the laboratory at the same water temperature after 55 days in captivity, 5.4 (0 to 11).

G. atratuli and G. margaritae fail to live and reproduce on fish kept in nonrunning water at between 19 and 26 C in laboratory aquaria, but will live and reproduce in running spring water at 12 C in laboratory aquaria.

An illustrated synopsis with a comparative table of measurements of known North American Gyrodactylus and a list of the species with brief reference to their differentiating characteristics are given. (Authors)

6052. Goldman, Charles R., and Robert G. Wetzel (Dept. of Zool., Univ. of California, Davis). 1963. A STUDY OF THE PRIMARY PRODUCTIVITY OF CLEAR LAKE, LAKE COUNTY, CALIFORNIA. Ecology, Vol. 44, No. 2, pp. 283-294.

By use of the C^{14} method for rapid bioassay, cultures of lake phytoplankton were assayed both in the lake and in the laboratory for limiting nutrient factors. Measurements of light, turbidity, temperature, pH, oxygen, alkalinity, and ionic composition were made in conjunction with productivity determinations.

Seasonal fluctuation in productivity appears to be correlated not only with light and temperature, but also with increasing turbidity initiated by inflow from winter rains.

Seasonal fluctuations in alkalinity and pH showed a positive correlation with productivity measurements and an inverse relationship to the turbidity and rainfall.

In summer and fall most of the carbon fixation

in the surface layers was by plankton of a size greater than 5-10μ. In the deeper strata in all seasons the ultraplankton contributed a larger proportion of the productivity. During winter and spring the productivity of the smaller forms dominated at all levels.

Of the nutrient additives tested, nitrate and sulphate stimulated the carbon fixation of natural phytoplankton populations. In combination, these 2 ions were particularly stimulating. It is doubtful, however, that under nonbloom conditions nutrient factors are now of great significance in limiting the primary productivity of Clear Lake. (Authors)

6053. Welsby, V. G. (Dept. of Elec. Engng., Univ. of Birmingham, England), J. H. S. Blaxter, and C. J. Chapman. 1963. ELECTRONICALLY SCANNED SONAR IN THE INVESTIGATION OF FISH BEHAVIOR. Nature, Vol. 199, No. 4897, pp. 980-981.

Preliminary tests with a new high resolution sector scanning sonar indicate that equipment of this type has an important application to research on fish behavior.

6054. Breidenbach, Andrew W., and James J. Lichtenberg (Div. of Water Supply & Pollution Control, Dept. Hlth. Edu., & Welfare, 1014 Broadway, Cincinnati, Ohio). 1963. DDT AND DEILDRIN IN RIVERS: A REPORT OF THE NATIONAL WATER QUALITY NETWORK. Science, Vol. 141, No. 3584, pp. 899-901.

As a part of the water-quality surveillance activities of the National Water Quality Network at 101 sampling stations, insecticides were identified in 38 samples from ten rivers during the period May through December 1962. Both DDT and dieldrin were identified by infrared and gas chromatographic analysis of carbon adsorption extracts. (Authors)

6055. Ross, Robert D., and James E. Carico (Dept. of Biol., Virginia Agric. Experi. Station, Virginia Polytechnic Inst., Blacksburg). 1963. RECORDS AND DISTRIBUTION PROBLEMS OF FISHES OF THE NORTH, MIDDLE, AND SOUTH FORKS OF THE HOLSTON RIVER, VIRGINIA. Technical Bulletin 161, 24 pp.

Since 1953 a survey has been made of fishes of the North, Middle, and South Forks of Holston River, Tennessee River system, Virginia. Records of fishes obtained, notes on drainage history, and distribution problems of Holston River fishes are discussed. (Authors)

6056. Walker, Charles R. (Bur. Sport Fish. & Wildl., La Crosse, Wisconsin). 1963. ENDOTHAL DERIVATIVES AS AQUATIC HERBICIDES IN FISHERY HABITATS. Weeds, Vol. 11, No. 3, pp. 226-232.

The disodium salt of 3,6-endoxohexahydrophthalic acid (disodium endothal) and the derivative identified by the manufacturer as the di-N,N'-dimethylococoamine salt of endothal (coded as TD-47) were particularly effective upon submersed species of aquatic vegetation as contact herbicides. Disodium endothal at concentrations of 0.5 to 10.0 ppmw was effective in controlling approximately 50 percent of the 19 species of plants involved in 270 tests. TD-47 at concentrations of 0.02 to 10.0 ppmw controlled 77 percent of the 11 plant species in 94 tests.

Algae (Chara, Cladophora, Pithophora, and Spirogyra) were more effectively controlled by TD-47 than by disodium endothal. Although TD-47 was at least 10 times more herbicidal than disodium endothal, it was about 100 times more toxic to fish. Disodium endothal was more than 50 percent effective on submersed aquatic plants at rates in excess of 2.5 ppmw with a wide margin of safety in fish (4- to 10-fold). Disodium endothal had a median tolerance limit ranging from 95 to 150 ppmw in the aggregate of nine fish species tested extensively. Median tolerance limits for TD-47 ranged from about 0.06 to 0.3 ppmw for five species of fish. TD-47 applied at a concentration lethal to fish (0.3 to 1.0 ppmw) was effective as a dual management tool in controlling vegetation and achieving partial or complete renovation of stunted fish populations.

Young, growing vegetation was most susceptible to control, and best results were achieved at water temperatures exceeding 60 F. Higher rates were required to kill plants as they matured and stands became dense. Endothal liquid formulations were superior to granules in controlling algal mats, floating and emergent plants. Granules were more effective on submersed rooted plants.

TD-47 residues were of short duration. The rate of disappearance depended on time and concentration. Detectable residues disappeared within 8 days following application of 0.3 ppmw and within 2 weeks for 0.6 ppmw. However, 1.0 to 3.0 ppmw took up to 25 days to disappear. Some residues were found in fish-food organisms from treated enclosures 3 weeks after application. Fish flesh showed no absorption of endothal-armeens at sublethal concentrations. Intraperitoneal injection of endothal into fish produced a disturbance of the osmoregulation. The physiological effect of endothal was measured by chemical analysis of blood serum. (Auth.)

6057. Schumann, George O. (Univ. of Wisconsin, Madison). 1963. ARTIFICIAL LIGHT TO ATTRACT YOUNG PERCH: A NEW METHOD OF AUGMENTING THE FOOD SUPPLY OF PREDACEOUS FISH FRY IN HATCHERIES. Prog. Fish-Cult. 25(4): 171-174.

An artificial light source has proved successful in attracting large numbers of perch larvae and fry into schools where they can be easily captured. The method provides a source of food for feeding predaceous game-fish fry in hatcheries. The author captured an estimated 90,000 larvae and 65,000 fry per man-hour. Practical application of the method by hatchery crews resulted in the

capture of 26,700 perch fry per man-hour and more than 4 million fry in one week. (Auth.)

6058. Snieszko, S. F. (Bur. Sport Fish. & Wildl., Kearneysville, West Virginia). 1963. AN AID IN THE PREPARATION OF BLOOD SAMPLES FROM FISH. Prog. Fish-Cult. 25(4): 174.

Plastic cups containing a dehydrated anticoagulant are used to prevent coagulation of fish blood during bleeding and sampling. (Auth.)

6059. Hublou, Wallace F. (Oregon Fish Comm., Clackamas). 1963. OREGON PELLETS. Prog. Fish-Cult. 25(4): 175-180.

A review of the development of the Oregon pellet and a summary of results from production use of this ration by the Oregon Fish Commission from 1959 to 1963. Overall food conversion after feeding some 3,593,000 lb. of pellets of chinook (Oncorhynchus tshawytscha), coho (O. kisutch), chum (O. keta) salmon, and steelhead trout (Salmo gairdneri) was 2.0 lb. of pellets to produce 1 lb. of fish; average food cost per lb. of fish produced was 24 cents; hatchery mortality was very low. Magnitude of adult coho returns was very encouraging (returns of other species were not complete at time of writing). (Auth.)

6060. Schwartz, Frank J. (Chesapeake Biol. Lab., Solomons, Maryland). 1963. A NEW ICHTHYOSPORIDIUM PARASITE OF THE SPOT (LEIOSTOMUS XANTHURUS): A POSSIBLE ANSWER TO RECENT OYSTER MORTALITIES. Prog. Fish-Cult. 25(4): 181-186.

An undescribed Ichthyosporidian infesting the spot (Leiostomus xanthurus) of Chincoteague Bay, Maryland, is noted. Discussion covers the parasite's incidence, effects upon the fish, appearance, and the possibility of its being causal agent for recent mid-Atlantic oyster mortalities. (Auth.)

6061. McCrimmon, Hugh R., and A. H. Berst (Ontario Agricultural Coll., Guelph, Canada). 1963. A SURVEY OF LICENSED COMMERCIAL TROUT HATCHERIES IN ONTARIO. Prog. Fish-Cult. 25(4): 187-192.

The production of brook trout, Salvelinus fontinalis, and rainbow trout, Salmo gairdneri, in the licensed private hatcheries in Ontario is reviewed. In 1962, 671,485 brook trout and 40,950 rainbow trout were sold for approximately $64,870. Stocks of brook trout and rainbow trout in the hatcheries at the end of 1962 totaled 2,393,965 and 115,885 respectively, with a total value of approximately $108,662. Some 58.5 acres of angling waters operated by these hatcheries grossed an additional $38,200. (Auth.)

6062. Cooper, Edwin L. (Pennsylvania State Univ., University Park), and Joseph H. Grosslight. 1963. DIFFERENTIAL SURVIVAL OF RAINBOW TROUT FED LIVING ORGANISMS AND HATCHERY DIETS. Prog. Fish-Cult. 25(4): 193-197.

Eggs from 1 pair of rainbow trout of domestic origin were hatched and 125 fry were counted into each of 4 feeding tanks. Trout in the 4 tanks were then given different food regimens for the period January 5 to June 1, 1961. The number of survivors in each of the tanks was then reduced to 80 by discarding the larger and smaller individuals and the 4 lots then marked and planted in a small natural stream from which other fish were excluded. At weekly intervals, the survival of the 4 lots was estimated by an electrofishing procedure until only a few remained. Trout fed entirely on hatchery diets had the best survival; those fed entirely on living organisms had the poorest survival. Possible explanations for the observed results are briefly discussed. (Authors)

6063. Crance, Johnie H. (Alabama Dept. of Cons., Montgomery). 1963. THE EFFECTS OF COPPER SULFATE ON MICROCYSTIS AND ZOOPLANKTON IN PONDS. Prog. Fish-Cult. 25(4): 198-202.

To control Microcystis in 5 ponds, copper sulfate was applied at rates of 0.7 to 0.9 lb. per surface acre by suspending cloth bags containing the chemical beneath the surface water. On various dates before and after application of copper sulfate, water samples were collected for colony counts of Microcysts, individual counts of copepods and cladocerans, and for chemical analyses. An appreciable decrease of Microcystis generally occurred after an application of copper sulfate, but within 25 days after treatment this alga reappeared in abundance. Generally, there was an inverse relationship between the abundance of Microcystis and zooplankters. The decay of Microcystis after applications of copper sulfate did not cause an oxygen deficiency that was harmful to the fish in the ponds. There was no correlation between the abundance of Microcystis and the concentrations of nitrogen, phosphorous, or calcium in the pond waters. (Auth.)

6064. Rucker, Robert R., Warner G. Taylor, and Donald P. Toney (Bur. Sport Fish. & Wildl., Seattle, Washington). 1963. FORMALIN IN THE HATCHERY. Prog. Fish-Cult. 25(4): 203-207.

The properties of formalin and its historical use as a control for fish parasites are discussed. A concentration of 1:4,000 for 1 hour is suggested for the control of most external protozoan and trematode parasites on most salmonids. (Authors)

6065. Cookingham, Russell A., and Carleton Hudson (Massacusetts Div. of Fish. and Game, Buzzards Bay). 1963. A UNIQUE SOURCE OF WARM-WATER FISH FOR RESTOCKING MANAGED WATERS. Prog. Fish-Cult. 25(4): 208-210.

To restock forage fish adequately in reclaimed warm-water ponds, it is desirable to have an easily accessible and economical source of the desired species. In Massachusetts yellow perch (Perca flavescens) and golden shiners (Notemigonus crysoleucas) are the species most commonly used and are easily salvaged from a boathouse in Plymouth County just before and after ice cover. Three to five inch yellow perch stocked at a rate of 25 to 50

per acre in newly reclaimed ponds provide an adequate number of sexually mature brood stock for the production of forage fish for the first year. Also, survival of these stocked perch is high, as most reach catchable size in less than 1 year after reclamation. (Authors)

6066. Maloy, Charles R. (Bur. Sport Fish. & Wildl., Dexter, New Mexico). 1963. HAULING CHANNEL CATFISH FINGERLINGS. Prog. Fish-Cult. 25(4): 211-212.

In 4 trips approximately 400,000 one to five inch channel catfish (Ictalurus punctatus), weighing 3,619 lb., were hauled an average distance of 750 miles in a sealed 488 gal. unit equipped with oxygen and recirculating systems. On 1 trip 1,200 lb. of fingerlings--3.5 lb. of fish per gal. of water, or a 1 to 2.4 ratio by weight--were carried. There were no losses during this 17-hour journey, and only negligible mortality occurred on the other 3 trips. The fish distribution unit used is described, and the hauling procedure is discussed. (Auth.)

6067. Bridges, W. R., and Herman O. Sanders (Bur. Sport Fish. & Wildl., Denver, Colorado). 1963. DIFFUSION OF HERBICIDES THROUGH PLASTIC FILM. Prog. Fish-Cult. 25(4): 213-214.

Laboratory tests with various herbicides and polyethylene and saran film demonstrated that herbicides will diffuse through these materials in aquatic situations. Tests with a liquid formulation of the propylene glycol butyl ether esters of 2, 4-D and polyethylene bags of 0.003-inch thickness, revealed that when 10 mg. of the herbicide was added to 5 l. of water in the bag and the bag was immersed in 10 l. of water, an equilibrium of herbicide in the water inside and outside the bag was reached after 96 hours. Similarly conducted tests with polyvinyl chloride film indicated that it is an effective barrier. Diffusion through the vinyl film did not occur in tests using the propylene glycol butyl ether esters of 2, 4-D and the butoxyethanol ester of silvex. (Authors)

6068. Gibbs, Robert H., Jr. (Div. of Fishes, U.S. Nat. Museum, Washington, D. C.). 1963. CYPRINID FISHES OF THE SUBGENUS CYPRINELLA OF NOTROPIS. THE NOTROPIS WHIPPLEI-ANALOSTANUS-CHLORISTIUS COMPLEX. Copeia, 1963, No. 3, pp. 511-528.

Notropis whipplei, N. a. analostanus, and N. a. chloristius are characterized and differentiated from related species of the subgenus Cyprinella. N. whipplei of the Mississippi River drainage and N. a. analostanus of Atlantic drainages, although morphologically quite similar, are regarded as separate species, with allopatry the deciding factor. N. a. chloristius, of the Santee River system, a comparatively distinct form previously given species rank, is regarded as a subspecies on the basis of apparent intergradation with N. a. analostanus in the Peedee River system. The meristic characters of the Cayuga Lake population of N. a. analostanus suggest introgression with N. s. spilopterus. In several morphometric characters N. a. analostanus displays a north-south cline to the Rappahannock and York river systems and reverses to the southward of these.

Synonymy and distribution are given for each form, and an explanation of present distributions is attempted. (Auth.)

6069. Sindermann, Carl J., and Kenneth A. Honey (U. S. Bur. Comm. Fish. Biol. Lab., Boothbay Harbor, Maine). 1963. ELECTROPHORETIC ANALYSIS OF THE HEMOGLOBINS OF ATLANTIC CLUPEOID FISHES. Copeia, 1963, No. 3, pp. 534-537.

Hemoglobins of five species of Atlantic clupeoid fishes, analyzed by agar electrophoresis for possible variant patterns that could be used to determine discreteness of subpopulations, were remarkably similar in numbers and mobilities of fractions. No abnormal hemoglobin patterns were found in the samples examined. One species (Atlantic herring, Clupea harengus) was sampled throughout much of its area of abundance in the western North Atlantic Ocean, and at various ages and maturity conditions, without finding variant hemoglobin patterns. (Authors)

6070. Young, Parke H. (California State Fisheries Lab., Terminal Island). 1963. THE KELP BASS (PARALABRAX CLATHRATUS) AND ITS FISHERY, 1947-1958. Calif. Dept. Fish and Game, Fish Bull. 122, 67 pp.

During the 12-year period 1947-1958, a southern Californian sport fishing fleet of up to 371 vessels reported daily catch by species. The kelp bass was among the top five species taken. By 1950, statistical and field observations showed undesirable changes had taken place in the bass populations. The principal fishing grounds are semi-isolated, geographically and by fishery practice. Population structure and fishing success in each is a function of the natural productivity, average fishing pressure, and abundance of competing species.

Tagging showed that bass were non-migratory and slow growing. Age-length based on scales agreed closely with growth data by tagging. In general, kelp bass food items ranged from small crustacea to fish. Bass as small as 8 inches showed signs of maturity and spawning occurred from April to October. Hermaphroditism was not found in a sample of 65 fish--although prevalent in other serranid fishes.

The annual mortality rate was estimated at 25 percent. The greatest yield, by weight, was computed for annual mortalities of 25 and 30 percent.

A size limit of 10 1/2 inches was imposed in 1953. Periodic half-inch increases ended with a 12-inch limit in 1959. Although too early to evaluate the full effect of the size limit, an abundance of sub-legal bass has been noted. Annual catches in 1961 and 1962 compare favorably with those of early postwar years. (Auth.)

6071. Walker, Charles R. (Missouri Cons. Comm., Columbia). 1963. TOXICOLOGICAL EFFECTS OF HERBICIDES ON THE FISH ENVIRONMENT. The Univ. of Missouri Bulletin, Vol. 64, No. 24, pp. 17-34.

Bioassay methods showed that acute toxicity to fish was a function of concentration dependent upon the time of exposure and effect of water temperature. The toxicity of the chlorinated hydrocarbon pesticides was somewhat selective in establishing an order of sensitivity for various fish species. Small variations in the side chain, alterations in the salt or ester form, manipulation of the carrier and use of wetting agent or emulsifier had a marked effect upon the toxicity of the pesticide to fishes. The mode of action of the chemical toxicity, the degradation and detoxification of the material also function in the toxicology. Subtle "trace effects" of the chemical toxicity are reflected in the physiology of the fishes.

A detailed study was made on the degradation and residues of endothal dimethylcocoamine which was used as an aquatic herbicide. The chemical and bioassay methods of analysis revealed that the breakdown of this herbicide was a direct functional relationship of time and concentration. Rapid degradation occurred in the water at lower concentrations (0.1 to 0.3 ppmw), while greater time was required with increased concentration. The residue from the 10 ppmw dosage rate required nearly 25 days to disappear. No residues could be detected in fish at sub-lethal doses (0.05 to 0.1 ppmw). Intraperitoneal injections of 200 to 500 mg/K were found to decrease appreciably within 3 to 4 weeks in the chemical assays of the fish flesh. Although field applications in excess of the 1 ppmw dosage rate destroyed the bottom fauna, the chemical analysis recovered some residues at the sublethal dosage rates of 0.3 to 0.6 ppmw. Residues could not be distinguished from the natural long-chain amines at lower dosage rates.

6072. Wise, John P. (U. S. Bur. Comm. Fish., Washington 25, D. C.). 1963. BIBLIOGRAPHY ON THE BIOLOGY OF THE COD, GADUS MORHUA, AND RELATED SPECIES. U. S. Fish and Wildlife Service, Fishery Bulletin 215, Vol. 62, 56 pp.

A bibliography of 1,020 references on the biology of the cod, Gadus morhua L., and related species of North American members of the genus Gadus which is reasonably complete through 1959. An extensive subject and geographical area index is included. (Auth.)

6073. Brynildson, Oscar M. (423 N. Pinckney, Madison 3, Wisconsin), Vernon A. Hacker, and Thomas A. Klick. 1963. BROWN TROUT. ITS LIFE HISTORY, ECOLOGY AND MANAGEMENT. Wisconsin Cons. Dept. Publication 234, 15 pp.

Includes the classification, distribution, description, habits, habitat, reproduction, growth, longevity, harvest, mortality rates, ecology, angling, economic value and management in Wisconsin.

6074. Henderson, Nancy E. (Dept. of Zool., Univ. of Alberta, Calgary, Alberta, Canada). 1963. INFLUENCE OF LIGHT AND TEMPERATURE ON THE REPRODUCTIVE CYCLE OF THE EASTERN BROOK TROUT, SALVELINUS FONTINALIS (MITCHILL). Journal of the Fisheries Research Board of Canada, Vol. 20, No. 4, pp. 859-897.

Brook trout were exposed to photoperiods ranging from 4 to 20 hours per day and were held either at 8.5° C or at 16°. The average diameter of the ova was used as an index of ovarian development while testicular maturation was determined from histological preparations.

The gonadal cycles of both male and female trout were markedly affected by different photoperiodic regimes. The influence of long or short photoperiods depends upon the phase of gametogenesis in progress at the time and on the photoperiod in effect during earlier stages of the gonadal cycle. Evidence is presented which suggests that the maturation cycle of the gonads may be regulated by the normal seasonal changes of day length.

An accelerated light regime can hasten the time of functional maturity in adult trout, but is without effect when applied to maturing fish in which gametogenesis is taking place for the first time. It is suggested that a stimulative effect of environmental factors is dependent upon maturation of the hypothalamic-hypophyseal mechanism.

The rate of gonadal development is the same at 16° as it is at 8.5° provided the fish are exposed to natural day lengths. If fish are subjected to long or to short photoperiods, the gonadal response at 16° is quite different from that at 8.5°. (Auth.)

6075. Henderson, Nancy E. (Dept. of Zool., Univ. of Alberta, Calgary, Alberta, Canada). 1963. EXTENT OF ATRESIA IN MATURING OVARIES OF THE EASTERN BROOK TROUT, SALVELINUS FONTINALIS (MITCHILL). Journal of the Fisheries Research Board of Canada, Vol. 20, No. 4, pp. 899-908.

Counts were made of the number of developing ova during the secondary growth phase of the oogenetic cycle in several groups of brook trout. An adjustment was made for the growth of the females since they increase appreciably in length during the secondary growth phase of the ova. Fecundity counts were then corrected to fish of a mean adjusted length. The results indicate that there is no major reduction in the number of developing ova during the secondary growth phase. (Auth.)

6076. Johnson, W. E., and C. Groot (Fish. Res. Bd. of Canada, Biol. Sta., Nanaimo, B. C., Canada). 1963. OBSERVATIONS ON THE MIGRATION OF YOUNG SOCKEYE SALMON (ONCORHYNCHUS NERKA) THROUGH A LARGE, COMPLEX LAKE SYSTEM. Journal of the Fisheries Research Board of Canada, Vol. 20, No. 4, pp. 919-938.

The seaward migration of sockeye salmon smolts through the Babine Lake system to its outlet is examined by extensive tagging, direct

observations and experimental orientation tests. The migration appears to be a well-oriented, non-random movement; it apparently commences from all lake regions at about the same time, suggesting a common triggering stimulus. When migrating, the smolts swim at a speed of 0.65 to 1.0 feet per second. The migration appears to take place primarily at near-surface depths; diurnally, most of the migration activity appears centered around the evening dusk period. There is a consistent increase in rate of travel as the season progresses; in large part this appears a result of increasing migration drive. Orientation tests with a view of only the sky show the smolts capable of time-compensated orientation in relation to celestial phenomena, and such tests at various points along the migration route show the preferred direction of smolts to correspond with the direction of most direct route to the outlet. Most smolts of the system show a constant preference for the northwesterly direction which would lead them rather directly to the outlet. However, one group which in the course of its migration to the outlet must make a 180° turn clockwise from southeast to northwest is found to have a corresponding shift in directional preference with time. Simple one-direction orientation, in one case shifting with time is sufficient to account for ability to find the outlet. A positive relation is shown between rate of travel of tagged smolts and the hours of sunshine on days subsequent to their release. (Authors)

6077. Clancy, Dan W. (Coll. of Fish., Univ. of Washington, Seattle). 1963. THE EFFECT OF TAGGING WITH PETERSEN DISC TAGS ON THE SWIMMING ABILITY OF FINGERLING STEELHEAD TROUT (SALMO GAIRDNERI). Journal of the Fisheries Research Board of Canada, Vol. 20, No. 4, pp. 969-981.

Fingerling steelhead trout were given individual performance tests in an experimental flume. Barriers confined the fish to a 10-foot (1 foot = 30.48 cm) testing section where they swam against a constant velocity of 2.5 feet per second. The end point of each test was reached when the fish was fatigued enough to allow itself to be impinged by the water flow on a net barrier. The study was designed to test what effect the application of Petersen disc tags had on swimming endurance, by comparing tagged, handled, and control groups.

No permanent reduction of swimming endurance was experienced by the handled group (tag pin inserted, then removed). The tagged group experienced a permanent drop of about 50% in their swimming endurance due to the presence of the tag. (Auth.)

6078. Lindsey, C. C., and T. G. Northcote (Inst. of Fish., Univ. of British Columbia, Vancouver, B. C., Canada). 1963. LIFE HISTORY OF REDSIDE SHINERS, RICHARDSONIUS BALTEATUS, WITH PARTICULAR REFERENCE TO MOVEMENTS IN AND OUT OF SIXTEENMILE LAKE STREAMS. Journal of the Fisheries Research Board of Canada, Vol. 20, No. 4, pp. 1001-1030.

Movements of shiners through two-way traps on inlet and outlet streams of a small British Columbia lake were studied from 1956 to 1962. The date on which adults first entered the inlet each spring corresponded to the first rise of daily maximum stream temperature above 10° C. Days on which increased numbers of shiners ascended the inlet were positively associated with days of rising daily maximum water temperature, and were not associated with water levels. Egg deposition occurred both in daylight and darkness. Downstream movement of shiner fry was greatest during periods of turbidity, and occurred largely during darkness. Shiners first spawned at age III or older; some lived to age V or VI. Number of adult shiners over 79 mm fork length was estimated by Petersen marking experiments to be about 13,000 in the 42-acre lake. A large interchange of adults took place in some years between the lake and parts of the watershed upstream; a small interchange occurred downstream. Many shiners entered a stream more than once each year. Many survived to spawn in two or more successive years. Movement into the streams varied markedly in different years and was small compared with the number of adults in the lake. Homing is suggested as a mechanism which determines the proportion of the inlet-, outlet-, and lake-spawning in this species. (Authors)

6079. Bary, B. McK. (Inst. of Oceanog., Univ. of British Columbia, Vancouver, B. C., Canada). 1963. TEMPERATURE, SALINITY AND PLANKTON IN THE EASTERN NORTH ATLANTIC AND COASTAL WATERS OF BRITAIN, 1957. II. THE RELATIONSHIPS BETWEEN SPECIES AND WATER BODIES. Journal of the Fisheries Research Board of Canada, Vol. 20, No. 4, pp. 1031-1065.

Occurrences of seventeen species of zooplankton from near-surface oceanic and coastal waters about Britain have been correlated with temperatures and salinities, in temperature-salinity-plankton (T-S-P) diagrams, for the 12 months of 1957. Species exhibit distinctive relationships to the several water bodies, as these have been defined in temperature-salinity (T-S) diagrams. Similar relationships between species have been used as a basis to group species together and 6 such groups are discussed. The species of three of the groups are oceanic; one of these groups is restricted to warm water, but the others are less restricted. A fourth group consists of species confined to coastal waters. The remaining two occur in oceanic, mixed oceanic-coastal and coastal waters. The relationships to the water bodies are shown to persist throughout the seasonal fluctuations of properties in the waters. (Auth.)

6080. Tibbo, S. N., D. J. Scarratt, and P. W. G. McMullon (Fish. Res. Bd. of Canada, Biol. Sta., St. Andrews, N. B., Canada). 1963. AN INVESTIGATION OF HERRING (CLUPEA HARENGUS L.) SPAWNING USING FREE-DIVING

TECHNIQUES. Journal of the Fisheries Research Board of Canada, Vol. 20, No. 4, pp. 1067-1079.

Free-diving (Scuba) techniques were used to survey a herring spawning bed near Blanchard Point, Chaleur Bay, N. B., in May 1962. The spawning bed occupied a long, narrow area running parallel with and near the shore in depths of 4-20 feet (1.3-6 m). The total area surveyed was 448,800 square yards (375,200 sq m) and the total number of herring eggs was estimated to be 35.46 X 10^{11}. The number of spawning herring was calculated to be 185 million fish (54.7 million pounds or 24,812 metric tons). The commercial fishery took 2.2 million pounds (998 metric tons) in the vicinity of the survey area which represents a fishing mortality rate of 4.0%. Hatching started about May 24 when large numbers of herring larvae 5-7 mm long were captured with plankton nets. (Authors)

6081. Stewart, James E., and H. E. Power (Fish. Res. Bd. of Canada, Technol. Res. Lab., Halifax, Nova Scotia). 1963. A SEA WATER AQUARIUM FOR MARINE ANIMAL EXPERIMENTS. Journal of the Fisheries Research Board of Canada, Vol. 20, No. 4, pp. 1081-1084.

The facilities and sea water supply installed at the Halifax Technological Research Laboratory for the purpose of holding and working with live marine animals under conditions approximating the natural environment are described.

6082. Stewart, James E. (Fish. Res. Bd. of Canada, Technol. Res. Lab., Halifax, Nova Scotia). 1963. AN ARRANGEMENT FOR AUTOMATICALLY AND REPRODUCIBLY CONTROLLING AND VARYING ILLUMINATION IN BIOLOGICAL EXPERIMENTS. Journal of the Fisheries Research Board of Canada, Vol. 20, No. 4, pp. 1103-1107.

Described is a versatile and inexpensive arrangement for illuminating an extensive system of tanks, cages or other enclosures allowing the amount of light to be varied continuously and reproducibly throughout a 24 hour cycle.

6083. Telitchenko, M. M. 1962. THE ROLE OF METABOLISM OF SUBSTANCES IN FISH IN THEIR ACCUMULATION OF RADIOISOTOPES. (O ROLI OBMENA VESHCHESTV RYB V AKKUMULYATSII IMI RADIOIZIOTOPOV.) Nauchn. Dokl. Vysshei Shkoly. Biol. Nauki 3. 90-93; Referat. Zhur., Biol., 1963, No. 3I74; Biological Abstracts, Vol. 43, No. 4, Abst. No. 12959. 1963.

The effect of metabolism was studied in the accumulation by fish of $Sr^{90}(Y^{90})$ from water solutions of $Sr(NO_3)_2$. It was established that scaly carp in darkened aquariums and a temperature of -1 to +6° (conditions close to the iced-over winter) accumulated $Sr^{90}(Y^{90})$ approximately 2 times less than in lighted aquariums at a temperature of +6 to +20°. Carassius carassius receiving food, accumulated $Sr^{90}(Y^{90})$ in larger quantities than hungry fish. The assumption that Y practically did not penetrate across the biological barriers was verified.

6084. Barlow, George W. (Max-Planck-Inst. Verhaltensphiol., Seewiesen Post Starnberg, West Germany). 1963. ETHOLOGY OF THE ASIAN TELEOST BADIS BADIS. II. MOTIVATION AND SIGNAL VALUE OF THE COLOR PATTERNS. Animal Behaviour 11(1): 97-105; Biological Abstracts, Vol. 43, No. 4, Abst. No. 12971. 1963.

The primary elements of the color pattern in Badis badis are the body colors, body bars, eye-slash, and three ocelli. Eleven more or less typical color patterns can be recognized; each occurs in characteristic situations, some under a wider range of circumstances than others. Pronounced fright is correlated with the palest coloration, moderate fright with thin disruptive bars, and increasing aggressiveness with distinct markings, such as broad bars and dark fins, and darker coloration. Sexually motivated males are black, females pale, colors associated with extreme aggressiveness and fright, respectively. When actually spawning in the burrow held by the male, the female is dusky brown with the double eye-slash and the dorsal and caudal ocelli present. Manifesting the dorsal and caudal ocelli in other circumstances seems to indicate "without territory". Parental males are dark, but seldom black. (Auth.)

6085. Frost, Winifred E. (Freshwater Biol. Assoc., Ambleside, England). 1963. THE HOMING OF CHAR SALVELINUS WILLUGHBII (GÜNTHER) IN WINDERMERE. Animal Behaviour 11(1): 74-82; Biological Abstracts, Vol. 43, No. 4, Abst. No. 12989. 1963.

In Windermere the char, Salvelinus willughbii, shows two populations separated from each other by the time and place of their spawning: (1) autumn spawners which breed in November-December, some on the lake shore and some in the inflowing river, (2) spring spawners which breed in February-March in deep water of the lake. For several seasons autumn and spring spawners were tagged on their breeding grounds which were in different places. Recaptures of the tagged fish on their correct grounds established the fact that the autumn and spring spawning char are distinct populations isolated from each other by time and place of breeding, also showed that sexually mature char return to the particular spawning ground which they had used at previous spawnings. This homing behavior was tested by "displacement experiments" in which breeding char were transferred to places, in lake and running water, at various distances from the site, to find out if they returned to their own spawning ground in the same season. Recaptures of displaced char showed that they returned to the place from which they had been removed, sometimes within twenty-four hours of their displacement, whether the char was a lake or a river spawner. Autumn and spring spawners differ morphologically. The maintenance of this differentiation depends on

the homing behavior of the spawners because this prevents cross-fertilization. It is suggested that when strict homing does not occur the deviation is due to abnormal conditions on the usual spawning ground. The positive value of deviation to the survival of a species is discussed. For Windermere char information on homing is being sought by plantings of eggs and fry. (Auth.)

6086. Mackintosh, J., and N. S. Sutherland (Oxford Univ., Oxford, England). 1963. VISUAL DISCRIMINATION BY THE GOLDFISH: THE ORIENTATION OF RECTANGLES. Animal Behaviour 11(1): 135-141; Biological Abstracts, Vol. 43, No. 4, Abst. No. 12997. 1963.

The experimental situation, which involved presentation of stereometric shapes and food reward taken directly from the center of the shape, led to efficient learning of shape discrimination by goldfish. The goldfish had more difficulty in discriminating two oblique rectangles in opposite 45° rotations from the horizontal than in discriminating a vertical from a horizontal rectangle. The goldfish unlike the octopus can master the discrimination of two obliques to a high level of accuracy, although it is not learning in terms of the total configuration of stimuli but in terms of the separate orientations of the two rectangles. Also, a goldfish which has learned to discriminate a horizontal from a vertical rectangle treats a rectangle at 35° from the horizontal as equivalent to a horizontal and one at 55° from the horizontal as equivalent to a vertical. Among other findings: Animals discriminated more readily between black shapes on a white background than between white shapes on a black background. There was good but not complete transfer when the brightness relationship between shapes and background was reversed. As in every other species tested (cf. Sutherland, 1961) goldfish showed better transfer to larger versions of the original shapes than to smaller. Transfer performance on shapes of four times the area of the originals was actually better than performance on the originals. After being trained with two shapes presented simultaneously, fish transferred to a situation in which the shapes were presented successively. However, they made more mistakes when the negative shape was presented alone than when the positive was presented, i.e., they tended to swim to the shape rather than to the opposite side even when the negative shape was presented. The findings recommend the goldfish for use in investigating problems of shape recognition and further work on this question is at present being undertaken. (Authors)

6087. Stout, John F. (Walla Walla Coll., College Place, Washington). 1963. THE SIGNIFICANCE OF SOUND PRODUCTION DURING THE REPRODUCTIVE BEHAVIOR OF NOTROPIS ANALOSTANUS (FAMILY CYPRINIDAE). Animal Behaviour 11(1): 83-92; Biological Abstracts, Vol. 43, No. 4, Abst. No. 13019. 1963.

A brief description of the reproductive behavior of Notropis analostanus was given. Sounds produced by fighting males increased the occurrence and average duration of the aggressive behavior of reproductively mature males. Sounds produced when males court females increased the occurrence of aggressive behavior between males, but did not increase the average duration of aggressive behavior. "Solo-spawning" increased when the courtship sounds were played back although no females were present. Courtship sounds, when played back to 1 male and 2 females, increased the occurrence and average duration of courtship behavior. Fighting sounds when played back to 1 male and 2 females did not increase the occurrence and average duration of courtship behavior. Males are able to discriminate between the two sounds. No orientation to sound sources was indicated. (Auth.)

6088. Briskina, M. M. 1960. METHODS OF PROVIDING LIVE FOOD FOR YOUNG FISH IN FISH HATCHERIES. (SPOSOBY OBESPECHENIYA ZHIVYMI KORMAMI MOLODI RYB NA RYBOVODNYKH ZAVODAKH.) Moscow; Rybn. Khoz. 133-142; Referat. Zhur., Biol., 1962, No. 22Zh364; Biological Abstracts, Vol. 43, No. 4, Abst. No. 13067. 1963.

In breeding crustaceans to serve as live food for young fish, species must be chosen which are capable of rapid population explosion. In the Chaikand fish hatchery from May through October, Daphnia magna were raised most successfully, good under any climatic conditions. Parthenogenetic females were found in the winter, during which time their fecundity was very high--up to 142 specimens in one brood. The high fertility in the winter period was associated with the good food conditions; the slow growth rate and development of the young was the result of low temperatures. A new method of operating Daphnia tanks was developed in which each tank was fished every other day for 6-9 months. Operation without change of water and new inoculation with Daphnia made the period of utilization twice as long; moreover, production was 30% more than with a single removal. Highest productivity, 40-60 g/m^3/day, was observed in July to September. The following are possible organisms for rearing: Pontogammarus robustoides, which lives in the Don and Volga deltas; Streptocephalus torvicornis, which are eaten by young salmon; and Moina brachiata, which in Azerbaijan hatcheries must be bred in early spring, and be replaced by M. rectirostris in the summer. During the period young salmon shift to eating live foods, it is possible to breed "chidolus". Among the free-living Nematoda, Panagrelus redivivus were easily adapted to breeding.

6089. Smirnova, L. I. (Inst. Reservoir Biol., Acad. Sci. USSR, Borok, USSR). 1962. ON THE SEASONAL CHANGES IN THE BLOOD OF FISHES OF RYBINSK RESERVOIR. (O SEZONNYKH IZMENENIYAKH KROVI RYB RYBINSKOGO VODOKHRANILISHCHA.) Vopr. Ikhtiol. 2(4): 677-686; Biological Abstracts, Vol. 43, No. 4, Abst. No.

13868. 1963.

Based on blood taken from the caudal arteries of 650 healthy adult specimens of more than 8 species from Rybinskii Reservoir during 1959-1960, results showed that for all fishes similar seasonal changes in the hemoglobin concentration and erythrocyte (RBC) counts occurred. Considering 16.67 g. of hemoglobin per gram of blood as 100%, hemoglobin decreased from a high in January to as low as 35% late spring and early summer, prior to rising again in the latter part of the summer. The RBC number is more or less directly proportional to the hemoglobin concentration. Seasonal changes in leukocyte (WBC) numbers were less correlated with temperature and varied from 10-90 thousand/mm^3 in winter to 20-285 thousand/mm^3 in summer. Serum-albumin concentrations increased from August, 1959, to spring, then dropped reaching a low in July, 1960, but were not so seasonal as hemoglobin and RBC changes. The higher hemoglobin and RBC values for winter are believed to be related to the lower water temperatures and concomitantly lower O_2 tensions. Increases in WBC, and, possibly, serum-albumin values are tied to increases in the food supply. (L. P.)

6090. Linton, Thomas L. 1961. A STUDY OF FISHES OF THE ARKANSAS AND CIMARRON RIVERS IN THE AREA OF THE PROPOSED KEYSTONE RESERVOIR. Oklahoma Fishery Research Lab. Report No. 81, 30 pp.

A pre-impoundment survey was conducted in the portion of the drainage area of the Arkansas and Cimarron Rivers which will be inundated by the proposed Keystone Reservoir.

Ten of the most abundant sport and rough fishes collected, for which age and growth determination was possible, were studied and their growth rates compared with Oklahoma State averages.

Estimation of the population and the standing crop of fishes in pounds per acre in a small portion (0.6 acre) of a creek which empties into the Arkansas River was made.

A creel census was conducted during portions of the months of July, August, and September of 1960 revealing a very poor yield of fishes per unit of effort. (Auth.)

6091. Berry, Frederick H., and Izadore Barrett (U. S. Bur. Comm. Fish., Biol. Lab., La Jolla, California). 1963. GILLRAKER ANALYSIS AND SPECIATION IN THE THREAD HERRING GENUS OPISTHONEMA. Inter-American Tropical Tuna Commission Bulletin, Vol. VII, No. 2, 77 pp.

The thread herrings, genus Opisthonema, family Clupeidae, are marine fishes that occur only in tropical and subtropical waters off both coasts of the American continent. The genus is composed of one Atlantic species and four Pacific species. Opisthonema oglinum (LeSueur), the single species in the western Atlantic Ocean, occurs from Brazil to Massachusetts, at Bermuda, and throughout the West Indies. Opisthonema libertate (Günther), Opisthonema bulleri (Regan), and Opisthonema medirastre, new species, are Pacific coastal species which occur together from Peru to Mexico (with at least one occasionally in California). Opisthonema berlangai, new species, is confined to the vicinity of the Galapagos Islands.

The five species show only slight differences in most morphological characters. Practical separation of the species is based on a combination of two considerations: (1) geographical area of occurrence and (2) the pattern of increase in the numbers of gillrakers in relation to standard length.

The numbers of gillrakers on the three segments of the first gill arch increase with the growth of the fish to about 120 mm S. L. in O. oglinum, to increasingly larger sizes in O. bulleri, O. medirastre, and O. berlangai, and apparently throughout life in O. libertate. Counts and comparisons of the numbers of gillrakers of the ceratobranchial segment of the first gill arch are the most convenient method for separating the five species. Specimens from colder waters tend to have fewer gillrakers than those from warmer waters. (Authors)

6092. Joseph, James. 1963. FECUNDITY OF YELLOWFIN TUNA (THUNNUS ALBACARES) AND SKIPJACK (KATSUWONUS PELAMIS) FROM THE EASTERN PACIFIC OCEAN. Inter-American Tropical Tuna Commission Bulletin, Vol. VII, No. 4, 36 pp.

Fecundity estimates of yellowfin tuna from the Eastern Pacific were examined by sub-area of collection, but no differences were detectable. A single regression of fecundity on fish size adequately summarizes the data available at this time, and they provide no evidence of racial differentiation among yellowfin within the Eastern Pacific.

There is, however, a difference between the fecundity-length relationships for yellowfin from the Eastern Pacific and those from Hawaii. As previously indicated, yellowfin from these two areas appear to be genetically isolated stocks. There is a possibility that the observed difference is due to differences in technique rather than real differences in fecundity of yellowfin tuna from the two regions.

It should be emphasized that if the comparison of fecundities between fish of the same species from different areas is to be used for studying stock identification, the fish to be studied should be taken during the same time period, to reduce variability due to environmental factors that are common to the different areas and are correlated in time. (Auth.)

6093. Ostroumova, I. N. 1960. BLOOD INDICES OF ONCORHYNCHUS GORBUSCHA, ACCLIMATIZED TO THE BASINS OF THE BARENTS AND WHITE SEAS. (O POKAZATELYAKH KROVI GORBUSHI, AKKLIMATIZIRUEMOI V BASSEINAKH BARENTSEVA I BELOGO MOREI.) Nauchn.-Tekh. Byul. Gos. Nauchn.-Issled. Inst. Ozernogo i Rechnogo Rybn. Khoz. 12. 30-32; Referat. Zhur., Biol., 1963, No. 2I74; Biological Abstracts, Vol. 43, No. 4, Abst. No. 13899. 1963.

The amount of hemoglobin (Hb) and erythrocytes

(E) in the blood of Oncorhynchus gorbuscha (OG) brood stock was high. Immature OG, developing for a long period on artificial food in the Taibol' plant, were in poor condition. The amount of Hb and E was very low. In blood smears and impressions of hemopoietic organs, indications of anemia and disturbances in hemopoiesis were observed. Immature O. keta in these conditions were in a good state. Indications of a disturbance in hemopoiesis were not observed. In immature OG existing in ponds on natural food, the amount of Hb and E was high, but some underyearlings had signs of anemia. This was explained by the species biology, by adaptability to rapid downstream migration to the sea.

6094. Ginzburg, A. S. (A. N. Severtsov Inst. Animal Morphol., Acad. Sci. USSR, Moscow, USSR). 1963. UNION OF GAMETES WITHOUT EGG ACTIVATION IN SALMONID FISHES. (SOEDINENIE GAMET BEZ AKTIVATSII YAITSA U LOSOSEVYKH RYB.) Zhur. Obshchei Biol. 24(2): 106-119; Biological Abstracts, Vol. 43, No. 4, Abst. No. 14872. 1963.

In salmonid fishes, the lake trout Salmo trutta L. morpha lacustris Linne and the salmon S. salar L. morpha sebago Girard, the union of gametes can take place without egg activation. This is observed upon egg insemination in coelomic fluid and Ringer solution. As shown by cytological investigation in these media, the spermatozoon reaches the egg surface and the anterior part of its head gets embedded in the cortical layer of the cytoplasm, although the egg remains unchanged in its appearance. The development of the egg starts after it is placed into water. The phenomena of union of the gametes and egg activation can be separated in time and combined in any sequence. A considerable autonomy of these phenomena seems to be related to the structural peculiarities of the spermatozoon of salmonid fishes, namely, to the absence of the acrosome (this evidence was supplied by electron-microscopic study of trout spermatozoa exposed to the action of egg water and other agents provoking acrosomal reaction). (Auth.)

6095. Lebedev, N. V., and Chêng Chêng-Tiun (Moscow State Univ., Moscow, USSR). 1963. CAUSES OF EGG HETEROGENEITY IN SOME FISHES. (PRICHINA RAZNOKACHESTVENNOSTI IKRY NEKOTORYKH RYB.) Zool. Zhur. 42(2): 256-267; Biological Abstracts, Vol. 43, No. 4, Abst. No. 14884. 1963.

By injecting blood vessels as well as using autoradiography, the authors found egg heterogeneity in carp and loach determined by feeding conditions during vitellogenesis. When fishes are kept over a year under different feeding conditions, a very considerable difference in the formation of large eggs was found, while the difference in fecundity was 3X as great. (Authors)

6096. Bullock, Wilbur L. (Dept. Zool., Univ. N. H., Durman, New Hampshire). 1963. INTESTINAL HISTOLOGY OF SOME SALMONID FISHES WITH PARTICULAR REFERENCE TO THE HISTOPATHOLOGY OF ACANTHOCEPHALAN INFECTIONS. Jour. Morphol. 112(1): 23-44; Biological Abstracts, Vol. 43, No. 4, Abst. No. 16511. 1963.

The histology of the post-cecal intestine and the rectum was studied in 4 species of salmonid fishes (Salvelinus fontinalis, Salmo gairdneri, S. trutta, and S. salar). In addition, the first 2 species were studied in fish heavily infected with the acanthocephalan parasite, Acanthocephalus jacksoni. Marked effects of digestive activity were noted in the epithelium. Cell types associated with the epithelium include: lymphocytes, polymorphonuclear leucocytes, globular leucocytes, rodlet cells, and goblet cells. Species differences were noted mainly in the phosphatase activity of the granular cells and in the height and arrangement of the annulo-spiral septa of the rectum. The most pronounced effects of acanthocephalan infections are the damage to the epithelium and the proliferation of connective tissue. The epithelium was completely destroyed at the point of attachment of the proboscis and compressed in other areas. The connective tissue of the lamina propria was increased by both the development of fibrous tissue and an increase in the numbers of cells of most types. Many of these cells were abnormal. There was no capsule formation around the parasite but a layer of mucous was interposed between the parasite and the epithelium of the host. (Auth.)

6097. Zischke, James Albert (Tulane Univ., New Orleans, Louisiana), and Charles M. Vaughn. 1962. HELMINTH PARASITES OF YOUNG-OF-THE-YEAR FISHES FROM THE FORT RANDALL RESERVOIR. Proc. South Dakota Acad. Sci. 41: 97-100; Biological Abstracts, Vol. 43, No. 4, Abst. No. 16524. 1963.

6098. Demchenko, I. F. 1963. ON SEXUAL DIFFERENCES IN THE PIKE (ESOX LUCIUS L.). (O RAZLICHII POLOV U SHCHUKI (ESOX LUCIUS L.).) Vopr. Ikhtiol. 3(1): 190-193; Biological Abstracts, Vol. 43, No. 4, Abst. No. 16910. 1963.

In one-half year old pikes the males generally possess a narrow, longitudinal, slit-like anal opening, while females possess wider anal openings, unlike those of the males. The sexes may be conveniently separated (less than 3% error) on the basis of this character. Weight and size differences between the sexes at a given young age are less reliable. (L. T. P.)

6099. Mednikov, B. M. (All-Union Sci.-Res. Inst. Mar. Fish. and Oceanogr., Moscow, USSR). 1962. ON THE INFLUENCE OF WATER VISCOSITY ON VARIATION IN FISHES. (O VLIYANII VYAZKOSTI VODY NA IZMENCHIVOST RYB.) 1962. Vopr. Ikhtiol. 2(4): 640-647; Biological Abstracts, Vol. 43, No. 4, Abst. No. 16918. 1963.

Fishes with dorsal fins located far caudad and with shallow caudal peduncles are usually

fresh-water fishes. This condition is believed to be correlated with higher water temperatures and lower salinities, or, in other words, with reduced viscosity. The postdorsal distance and minimum body depths of R. rutilus from different geographical areas (based on evidence in literature) were plotted against computed viscosities for the waters of those areas given in Krümmel units (the viscosity of fresh-water at 0° C equals 100). The viscosities were computed from water temperature and salinity data for the season of activity. A strong correlation (. 76 and . 71 respectively) for increasing postdorsal distance versus decreasing minimum body depth with increasing viscosity was found. In a similar plot, a strong correlation (. 48) between minimum body depth and increasing viscosity was found for G. gobio. The postdorsal distance in A. alburnus was also found to be directly related to the viscosity value. The minimum body depth of A. alburnus was found to be inversely proportional to the viscosity. The cods show a decrease in minimum body depth with increasing viscosity interspecifically. Such meristic changes are believed to minimize resistant surface area in high viscosities or increase caudal thrust area in low viscosities. (L. P.)

6100. Prowse, G. A. (Trop. Fish. Cult. Res. Inst., Batu, Berendam, Malacca, Fed. Malaya). 1963. INTRODUCTIONS OF EXOTIC FISH (TILAPIA PISCES). Nature 197(4872: 1123; Biological Abstracts, Vol. 43, No. 4, Abst. No. 16924. 1963.

A list of introductions of Tilapia spp. into countries where they are not indigenous is being compiled by the author. The best has already been introduced extensively in several countries and if records are not compiled soon, it will be impossible to ascertain the identity of any particular fish.

6101. Girsa, I. I. (A. N. Severtsov Inst. Animal Morphol., Acad. Sci. USSR, Moscow, USSR). 1962. ON THE DECREASE OF PREDATION BY PREDATORS ON SMALL FISH WITH RESPECT TO THE FORMATION IN SMALL FISH OF CONDITION DEFENSE MECHANISMS. (OB UMEN'SHENII DOSTUPNOSTI KHISKCHNIKAM MELKIKH RYB V SVYAZI S OBRAZOVANIEM U NIHK OBORONITEL'NYKH USLOVNYKH REFLEKSOV.) Vopr. Ikhtiol. 2(4): 747-749; Biological Abstracts, Vol. 43, No. 1, Abst. No. 355. 1963.

When young Leucaspius delineatus, 50-60 mm long, were placed in a darkened aquarium in the presence of predacious som (a catfish), 80-100% were eaten within an hour. When these fish were released in a lighted aquarium, no predation occurred. Of the survivors accruing from releases in the dark aquarium in other experiments, several continued to survive several days. A possible acquired defensive behavior mechanism, produced in the space of a few hours, against som predation is suggested. (L. P.)

6102. Voronin, A. 1962. CONDITIONED REFLEXES IN FISH. (USLOVNYE REFLEKSY RYB.) Rybovodstvo i Rybolovstvo 2. 42-45; Biological Abstracts, Vol. 43, No. 1, Abst. No. 387. 1963.

In a review article, the author describes studies on the development of the conditioned food-getting reflex and the signals used in training the fish. Examples are given for cases where positive conditioned reflexes have been changed into negative ones. It is emphasized that fish respond to relative, and not to absolute, signs. The inability of fish to analyze and synthesize complex phenomena and to respond to more than 2 stimuli at the same time is discussed. The author considers the significance of conditioned reflexes with regard to the general behavior of fish along with some practical applications of interest to fishermen. (M. D.)

6103. Shkorbatov, G. L. 1962. ECOLOGICAL-PHYSIOLOGICAL CHANGE AND PROBLEMS ASSOCIATED WITH THE ACCLIMATIZATION OF AQUATIC ANIMALS. (EKOLOGO-FIZIOLOGICHESKAYA IZMENCHIVOST' I VOPROSY AKKLIMATIZATSII VODNYKH ZHIVOTNYKH.) Visshaya Shkola: Moscow 5: 247-248; Referat. Zhur., Biol., 1962, No. 22I24; Biological Abstracts, Vol. 43, No. 1, Abst. No. 444. 1963.

Physiological changes, which ensue during the process of acclimatization, are divided into 2 stages. In the first stage, use is made of adaptive means developed in the evolutionary process. In the second stage, beginning with the second generation, new adaptive physiological and biochemical changes occur. For example, during acclimatization of fish of northern waters to waters of lower latitudes, protein enzymes become more resistant to heat. Acclimatization is a process in which new climatic conditions become assimilated; it embraces the whole complex of adaptation to the totality of factors in the new environment. Not only separate organisms, but whole populations become acclimatized. Individually reversible physiological changes, such as physiological regulations in separate organisms, must be regarded merely as adaptations or accommodations.

6104. Aronov, M. P. 1962. THE ECOLOGICAL-PHYSIOLOGICAL FEATURES OF THE SENSE ORGANS OF CERTAIN FISH IN RELATION TO THEIR REACTIONS. (EKOLOGO-FIZIOLOGICHESKIE OSOBENNOSTI ORGANOV CHUVSTV NEKOTORYKH RYB V SVYAZI S IKH PISHCHEVYMI REAKTSIYAMI.) Vysshaya Shkola: Moscow. 5. 8-9; Referat. Zhur., Biol., 1962, No. 18I55; Biological Abstracts, Vol. 43, No. 1, Abst. No. 462. 1963.

The significance of various receptors in procurement of food was studied by blocking receptors in Black Sea fish that differed ecologically. The complex feeding reaction is sub-divided into several stages, with each stage governed by the activity of definite receptors and participation of corresponding reflexes.

6105. Barannikova, I. A. 1960. EFFECTS OF HYDRO-ELECTRIC INSTALLATIONS ON COMMERCIALLY IMPORTANT FISH STOCKS AND OBJECTIVES OF FISH MANAGEMENT UNDER THE NEW

CONDITIONS. (VLIYANIE GIDROSOORUZHENII NA ZAPASY FSENNYKH PROMYSLOVYKH RYB I ZADACHI RYBOVODSTVA V NOVYKH USLOVIYAKH.) Rybn. Khoz: Moscow. 92-103; Referat. Zhur., Biol., 1962, No. 22I75; Biological Abstracts, Vol. 43, No. 1, Abst. No. 466. 1963.

Results obtained from studies of the rivers Narova and Svir'. Sharp fluctuations in the level of these rivers in the course of 24 hours (2-3 m) resulted in destruction of littoral food organisms. Young fish perished, and spawning beds of bream, pike, and of other fishes dried up. Changes in current velocity led to the erosion of redds and upset the entire spawning activities of Salmonidae. Ecological-histological studies are carried out and diagrams of histological sections of fish gametes are presented. In the bay of the Narova River conditions for the propagation of Salmonidae fry deteriorated. Recommendations and measures for the preservation of supplies of commercially important fish are presented.

6106. Bozhko, A. M. 1962. CHANGES IN RELATIVE SIZE OF THE INTERNAL ORGANS OF LAKE SALMON WITH AGE. (VOZRASTNYE IZMENENIYA OTNOSITEL'NYKH RAZMEROV VNUTRENNIKH ORGANOV OZERNOGO LOSOSYA.) Akad. Nauk SSSR. Moscow-Leningrad. 138-143; Referat. Zhur., Biol., 1962, No. 19I33; Biological Abstracts, Vol. 43, No. 1, Abst. No. 471. 1963.

A survey was made in ponds of the Salminsk fish hatchery. A brief description of the ponds is given. Using weight and length indices, characteristic features of industrial organs of small salmon in the process of development and growth were determined. The relative size of the heart, gills, and gill filaments, was smaller, but the relative weight of the liver, intestines, and the length of the latter, was greater. Fertilization of the ponds led to faster growth of the fry and produced an increase in the relative length of the intestines. In nature females the relative weight of the heart, gills, liver and intestines was higher than in males. The relative size and weight of the internal organs could serve as an index for the appraisal of the various living conditions of fish.

6107. Bryan, Arthur H. (Fletcher High School, Jacksonville Beach, Florida). 1963. THE RED TIDE. Amer. Biol. Teacher 25(1): 53-54; Biological Abstracts, Vol. 43, No. 1, Abst. No. 473. 1963.

Causes of red tide, economic significance and influence on blooming are reported.

6108. Chermisina, V. T., S. E. Byzgu, and G. I. Stepanova. 1961. A STUDY OF THE EFFECTS OF ORGANIC FERTILIZERS, COMBINED WITH SUPPLEMENTARY FEEDING, ON OXYGEN CONDITIONS IN FISH-RAISING PONDS OF MOLDAVIA. (K IZUCHENIYU VLIYANIYA NEKOTORYKH ORGANICHESKIKH UDOBRENII V SOCHETANII C PODKORMKOI NA KISLORODNGI REZHIM VYROSTNYKH PRUDOV MOLDAVII.) Shtiintsa: Kishenev. 24-31; Referat. Zhur., Biol., 1962, No. 18I106; Biological Abstracts, Vol. 43, No. 1, Abst. No. 478. 1963.

Plant fertilizers at a rate of 200 kg/hectare, and natural foods at a rate not over 3 kg per kilogram body weight of fish being reared, were introduced into ponds. The range of O_2 concentrations in these ponds was found to be the same as in controls. Keeping the rate of natural fertilizer at the same value and adding artificial fertilizer at a rate of 458 kg/hectare resulted in an increase variability of O_2 concentration.

6109. Chugunova, N. I. 1961. PATTERNS OF GROWTH IN FISHES AND THEIR ROLE IN POPULATION DYNAMICS. (O ZAKONOMERNOSTYAKH ROSTA RYB I IKH ZNACHENII V DINAMIKE POPULYATSII.) Tr. Soveshch. Ikhtiol. Komissii Akad. Nauk SSSR 13. 94-107; Referat. Zhur., Biol., 1962, No. 16I54; Biological Abstracts, Vol. 43, No. 1, Abst. No. 479. 1963.

Problems of two types in growth studies are examined: back-calculation of length and weight, and compensatory growth. Experimental work as done in the Volga delta fishery (1956-57) with immature zander (Stizustedion lucioperca). Growth was studied by repeated weighing and measuring (8-9 times) of marked fish. Formation of spawning marks was traced by the gradual resorption of the scale edges and then their restoration. These processes coincided with changes in body form: during spawning there was a diminution of the body surface and after spawning the body form was restored. The spawning marks on the carp coincided with the annual cycle. Changes in the rate of growth in carp (in weight and length) were determined and related to food conditions, biological state of the fish, and hydrometerological conditions.

6110. Evropeitseva, N. V. 1962. GROWTH, RELATIVE NUMBERS AND THE QUESTION OF THE SIGNIFICANCE OF THE DWARF MALES IN ECOLOGICALLY DIFFERENT REPRESENTATIVES OF THE GENUS SALMO. (RAZVITIE, OTNOSITEL'NAYA CHISLENNOST' I VOPROS O ZNACHENII KARLIKOVYKH SAMTSOV U EKOLOGICHESKI RASLICHNYKH PREDSTAVITELEI RODA SALMO.) Vysshaya Shkola: Moscow. 5: 60; Referat. Zhur., Biol., 1962, No. 19I25; Biological Abstracts, Vol. 43, No. 1, Abst. No. 486. 1963.

There are 2 types of dwarf males in Salmo: those that migrate to the sea, and those that inhabit fresh waters. The differences in numbers of dwarf males of Salmo salar in northern European rivers can be explained by differences in the ecology of the population in different rivers.

6111. Faktorovich, K. A. 1960. EVALUATION OF SOME DIETS USED FOR BALTIC SALMON FRY BY MEANS OF HISTOPHYSIOLOGICAL EXAMINATION OF THE LIVER. (OPYT OTSENKI NEKOTORYKH DIET, PRIMENYAYUSHCHIKHYA DLYA MOLODI BALTIISKOGO LOSOSYA, PO DANNYM GISTOFIZIOLOGICHESKOGO ANALIZA PECHENI.)

Rybnoe Khoz: Moscow. 103-112; Referat. Zhur., Biol., No. 18I100; Biological Abstracts, Vol. 43, No. 1, Abst. No. 488. 1963.

Liver of Baltic salmon fry, which were fed on various food mixtures, was fixed by the Bouin method; sections were stained with malachite green by the Heidenhain method, and the area occupied by the cavities formed at the sites of dissolved fat was calculated. The ratio of the area occupied by the cavities to that occupied by the nuclei and liver cell plasma, and also the number of nuclei in the area of the specimen (5000 μ^2), were regarded as basic physiological indexes. Young fish reared on artificial foods in ponds were used as controls. The increase in the amount of liver fat and, consequently, the area occupied by the cavities of the specimens, was regarded as an index of impaired metabolism compared with normal metabolism. Judging by the condition of the liver (and fish-culture indexes) the most valuable foods were those composed of pure spleen or mixtures consisting of wheat by-products, fish oil, and brewer's yeast. Lack of fish oil and of brewer's yeast (in the diet) did not impair the fish-culture indexes, but it had an adverse effect on the condition of the liver. Poor indexes were obtained for fish fed on oligochaetes or on mixtures containing blood meal.

6112. Gorbunova, Z. A. 1962. HYBRIDIZATION OF COREGONIDAE AS A METHOD OF INCREASING THE PRODUCTIVITY OF KARELIAN LAKES. (GIBRIDIZATSIYA SIGOVYKH KAK ODIN IZ PUTEI POVISHENIA PRODUKTIVNOSTI OZER KARELII.) Akad. Nauk SSSR: Moscow-Leningrad. 77-79; Referat. Zhur., Biol., 1962, No. 18I95; Biological Abstracts, Vol. 43, No. 1, Abst. No. 492. 1963.

Work is reported on crossing Coregonus albula with C. lavaratus ludoga of Lake Onega. This work was begun in 1954. The average weight of fry of the hybrid C. albula X C. l. ludoga increased from 8g (1954) to 15.8 g (1956); that of fry of C. l. ludoga X C. albula increased to 22.5 g. High rate of growth during the 1st and 2nd years of cultivation in ponds, great pliability and adaptability to environmental conditions, utilization of benthos and plankton as food were observed. On the basis of these observations, stocking the lesser and middle-sized lakes of Karelia with hybrids of the whitefish family is suggested. The author reports that whitefish larvae were introduced into lakes Matko-yarvi (16 ha in area) and Nizhnee Gal'ozero.

6113. Kol'gaev, A. M. (Amur Dept., Pacific Ocean Sci.-Res. Inst. Fish. and Oceanogr., Khabarovsk, USSR). 1962. RELATION OF SURVIVAL OF EGGS OF AMUR FALL CHUM SALMON ONCORHYNCHUS KETA (WALB.) INFR. AUTUMNALIS BERG TO THE METHOD AND CONDITIONS UNDER WHICH THEY ARE SUPPLIED WITH WATER. (ZAVISIMOST' VYZHIVAEMOSTI IKRY AMURSKOI OSENNEI KETY ONCORHYNCHUS KETA (WALBAUM) INFR. AUTUMNALIS BERG OT SPOSOBA I USLOVII OMYVANIYA EE VODOI.) Vopr. Ikhtiol. 2(4): 742-745; Biological Abstracts, Vol. 43, No. 1, Abst. No. 503. 1963.

Factors affecting viability and rate of growth of salmon eggs deposited in experimental sand-filled boxes included not only O_2 concentration and water volume, but also the degree of "bathing" of eggs, the direction of the current, and the size of the sand used in the bed. Uniform bathing of all egg surfaces insures a supply of O_2 and effectively removes matabolic wastes. It is enhanced by optimal flow direction and larger grained sand. (L. P.)

6114. Konovalov, P. M. 1961. EXPERIMENTS WITH YOUNG STELLATE STURGEON ON RESPIRATION AND OXYGEN THRESHOLD. (OPYTY S MOLOD'YU SEVRYUGI NA DYKHANIE I KISLORODNYI POROG.) Akad. Nauk Kazakh SSR. 3. 93-105; Referat. Zhur., Biol., 1962, No. 18I81; Biological Abstracts, Vol. 43, No. 1, Abst. No. 504. 1963.

Observations were made from May to July 1957 on young Ural River Acipenser stellatus reared artificially. Fish aged from 24 hours after hatching up to 45 days old were used. Experiments on respiration were conducted for the same number of days at a water temperature of 19°-24° C. The absolute O_2 consumption by sturgeon fry was found to increase with age: at the age of 1 month it was 60 times as high as at the age of 1 day, and at age 45 days it was 200 times as high. Respiratory rate and oxygen threshold varied considerably with age. During the 1st 3 days after hatching the respiratory exchange of the larvae remained quite stable. Subsequently, 2 sensitive stages were displayed: (1) transition to respiration by means of external gills (4th day) marked by a sharp increase in O_2 consumption and a very high O_2 threshold; (2) transition to active respiration (7-8 days) accompanied by a high respiratory rate for 7 days, and a sharp increase in that rate on the 8th day. During this period great sensitivity to oxygen conditions was shown. Subsequently larvae manifested greater resistance to changing conditions. On the whole, during the 1st 15 days experimental larvae showed a subnormal respiratory exchange, a fact which was probably connected with the adverse conditions accompanying the transfer of sturgeon roe from the mouth of the Syr-Daria (in the lower reaches of the Ural River) to the fish pond.

6115. Kuz'min, A. N. 1962. CORRELATED VARIATIONS IN GROWTH, AGE AND SEXUAL MATURITY IN FISH LIVING IN VARIOUS GEOGRAPHICAL ZONES. (KORRELYATIVNIYA IZMENCHIVOST' ROSTA, VOZRASTA I POLOVOGO SOZREVANIYA U RYB, OBITAYUSHCHIKH V RAZNYKH GEOGRAFICHESKIKH ZONAKH.) Vysshaya shkola: Moscow. 112-113; Referat. Zhur., Biol., 1962, No. 19I32; Biological Abstracts, Vol. 43, No. 1, Abst. No. 510. 1963.

Comparative histological analysis of variations in growth, age and sexual maturity in whitefish and carp, living at various latitudes, is presented. The degree of development of the reproductive system differed in specimens of the same size and age in

differing climatic zones. The change from one stage of development to another depended on age and season of the year.

6116. Kuznetsova, I. I. 1962. AN EXPERIMENT IN RAISING FISH PRODUCTION OF BODIES OF WATER BY CONTROLLING THEIR WATER REGIME AND THE REPRODUCTION PERIODS OF THE FISH. (OPYT POVYSHENIYA RYBOPRODUKTIVNOSTI VODOEMOV PUTEM REGULIROVANIYA VODNOGO REZHIMA I SROKOV RAZMNOZHENIYA RYB.) Vysshaya Shkola: Moscow. 5: 112; Referat. Zhur., Biol., 1962, No. 18I98; Biological Abstracts, Vol. 43, No. 1, Abst. No. 511. 1963.

In reservoirs with controlled water systems, fish production can be raised 5-fold by regulating inundation periods, filling rates, and population density of carp stockings.

6117. Mamontova, L. N. 1961. ON THE INCREASE IN FISH PRODUCTIVITY OF PONDS THROUGH THE APPLICATION OF DIFFERENT DOSES OF MINERAL FERTILIZERS. (OB UVELICHENII RYBOPRODUKTIVNOSTI PRUDOV VNESENIEM RAZNYKH DOZ MINERAL'NYKH UDOBRENII.) Minsk. 173-178; Referat. Zhur., Biol., 1962, No. 21I89; Biological Abstracts, Vol. 43, No. 1, Abst. No. 519. 1963.

Experiments have shown that increasing the amount of nitrate nitrogen up to 7-10 mg/l and phosphorus up to 0.18 mg/l in pond water produces intensive blooming. In 1957 as a result of the application of mineral fertilizers the natural fish productivity increased from 2 to 7 metric centners/ha. The weight of the fish from fertilized ponds exceeded 25 g. Bluegreen algae did not develop in the fertilized ponds. Culturing fish in ponds fertilized exclusively with ammonium nitrate and superphosphate showed that it was possible to increase the natural productivity to 10 metric centners/ha with an individual fish weight of 24.1 g. With fertilizing every 3-5 days, feeding the fish, and seeding with 100-150 thousand fingerlings, the fish productivity can increase from 2 to 15 metric centners/ha if feeding begins in the middle of July.

6118. Matisone, M. N., and I. G. Mezhule. 1961. CHANGE OF THE CHEMICAL COMPOSITION OF THE WATER IN PONDS FED FROM BOGS BY FERTILIZATION AT THE "MUSHAS" FISH HATCHERY IN ORDER TO INCREASE THEIR FISH PRODUCTION. (IZMENENIE KHIMICHESKOGO SOSTAVA VODY PRUDOV BOLOTNOGO PITANIYA RYBOPITOMNIKA "MUSHAS" PUTEM UDOBRENIYA V TSELYAKH POVYSHENIYA IKH RYBOPRODUKTIVNOSTI.) Tr. Inst. Biol. Akad. Nauk Latviisk SSR 19: 71-108; Referat. Zhur., Biol., 1962, No. 17I95; Biological Abstracts, Vol. 43, No. 1, Abst. No. 522. 1963.

Mineral fertilizers were applied twice a month from May through August and vegetable fertilizers once a month in July and August. The result of such fertilization was an increase in the O_2 content up to 14.8 mg/l, pH of the water to 8.6, and a reduction of the free CO_2 content to zero. The greatest increase of the O_2 content was provided by the mineral fertilizers in ponds where lime had been used in previous years. Studies of the initial production of plankton and fish productivity of the ponds showed that bogwater ponds require the use of a combination of mineral fertilizers. Standards for fertilization are presented.

6119. Naumova, A. M., and A. I. Kanaev. 1962. EXPERIENCE IN THE TREATMENT OF CARP INFECTED WITH COCCIDIOSIS. (OPYT LECHENIYA KARPOV, BOL'NIKH KOKTSIDIOZOM.) Vopr. Ikhtiol. 2(4): 749-751; Biological Abstracts, Vol. 43, No. 1, Abst. No. 527. 1963.

Underyearling carp, infected with Eimeria cyprini, were fed food prepared with osarolum (1 mg/g food). As a result the number of oocytes with spores per fish decreased from 9.3 to 0.2--0 within a month and other symptoms were reduced to 7.5-25% of their original values. Osarolum is an effective antibiotic against carp coccidiosis. (L. P.)

6120. Powell, E. A. 1960. FISHERY STATISTICS OF THE UNITED STATES. 1960. U. S. Fish and Wildlife Serv., Statist. Dig. 53. 3-529; Biological Abstracts, Vol. 43, No. 1, Abst. No. 540. 1963.

A review of the fishery statistics for the year 1960 collected during 1960 and 1961 by the Branch of Statistics, Division of Resource Development. These include data on the volume and value of the catch of fishery products, employment in the fisheries, quantity of gear operated, number of fishing craft employed in the capture of fishery products, and information on the volume and value of the production of manufactured fishery products and by-products. (Auth.)

6121. Rannak, L. A. 1961. CORRELATION OF GROWTH AND SEXUAL MATURATION IN SPRING-SPAWNING HERRING (CLUPEA HARENGUS MEMBRAS). (SOOTNOSHENIE ROSTA I POLOVOGO SOZREVANIYA VESENNENERESTUYUSHCHEI SALAKI.) Tr. Soveshch. Ikhtiol. Komissii Akad. Nauk SSSR 13. 337-343; Referat. Zhur., Biol., 1962, No. 16I72; Biological Abstracts, Vol. 43, No. 1, Abst. No. 543. 1963.

The spring-spawning herring in the northeastern part of the Baltic Sea attain sexual maturity at the age of 2 or 3 years, depending on the conditions of nutrition and hibernation. In Riga Bay herring mature at the age of 2, and in the main part of the Gulf of Finland at 3 years. The accumulation of fat in the body determines the transition of gonads from the second stage to the third. With an adequate amount of nutritive substance, herring remain for a long time in the second stage of maturity. Growth in different years is highly variable. If the mode of the length distribution of the 2-year-olds exceeds 11.5 cm, then the 2-year-olds amount to approximately 50% of the spawning population. If it is less than 11.5 cm, then they are 30-40% of the total number. Herring growth is closely connected

with the abundance of food and high water temperature in the summer and fall months. A decisive factor is a sunny summer. A warm winter accelerates sexual maturation independent of growth in the preceding feeding period.

6122. Sakun, O. F., and M. N. Chistova. 1960. REASONS FOR THE PREMATURE HATCHING OF SALMONIDAE IN FISH HATCHERIES OF SOUTHERN SAKHALIN. (O PRICHINAKH PREZHDEVREMENNOGO VYKLEVA LOSOSEVYKH NA YUZHNO-SAKHALINSKIKH RYBOVODNYKH ZAVODAKH.) Rybnoe Khoz.: Moscow. 37-44; Referat. Zhur., Biol., 1962, No. 18101; Biological Abstracts, Vol. 43, No. 1, Abst. No. 544. 1963.

The mass destruction of salmon spawn, accompanied by the hatching of nonviable embryos or by death of the eggs, is attributed to the fungus Rhizopodium (Archemyceteae). It is thought possible that invasion by the fungus may have been aided by the adverse oxygen conditions of the part of the incubation period during which the respiratory organs were formed. For the control of the fungus the author suggests treatment with 1:200,000 aqueous solution of malachite green for a period of 30 minutes.

6123. Savvaitova, K. A. (Dept. Ichthyol., Moscow State Univ., Moscow, USSR). 1962. CHANGES WITH AGE IN THE LAKE-RIVER FORM OF SALVELINUS ALPINUS OF KAMCHATKA. (VOZRASTNAYA IZMENCHIVOST' OZERNO-RECHNOI FORMY SALVELINUS ALPINUS L. KAMCHATKI.) Vopr. Ikhtiol. 2(4): 597-603; Biological Abstracts, Vol. 43, No. 1, Abst. No. 547. 1963.

Following the larval period the char S. alpinus of Kamchatka undergoes at least 4 additional stages prior to breeding. These stages may be defined on the basis of changes in the char's ecology and concomitant meristic, nutritional and behavioral changes: breeding-ground stage 1 (30-50 mm long); slow-creek stage 2 (51-150 mm long); river and lake stage 3 (151-250 mm long); and sexual-maturation stage 4 (251-370 mm long). The number of food items increases from only 2--chironomids (75.5%) and aerial insects (24.5%)--in stage 1 to several--molluscs (95%), caddisflies, aerial insects, etc.--in stage 4. There is a corresponding increase in the relative length of the intestines and number of pyloric caeca with advance in stage. Other regularly occurring changes from stage 1 through stage 4 are: a decrease in schooling tendency; a gradual assumption of sexual dimorphism and distinctive coloration; and a change in position and modification of fins for faster and longer-distance swimming. (L. P.)

6124. Smirnov, A. I. 1960. SPAWNING CONDITIONS, GROWTH, AND THE BIOLOGICAL PROPERTIES OF ONCORHYNCHUS TSHAWYTSCHA FOR REARING PURPOSES. (USLOVIYA NERESTA, RAZVITIE I RYBOVODNOBIOLOGICHESKIE KACHESTVA CHAVYCHI.) Rybn. Khoz.: Moscow. 30-36; Referat. Zhur., Biol., 1962, No. 19I48; Biological Abstracts, Vol. 43, No. 1, Abst. No. 557. 1963.

A comparison of growth characteristics of chinook salmon in natural conditions and in fish hatcheries, as well as a calculation of the temperature and oxygen regimes in their redds, led to the assumption of an approximate norm in artificial rearing of chinooks of 30-70% O2 saturation of the water. The circulation in the apparatus must be above 1.0-1.5 cm/minute. For summer-spawning chinooks, favorable temperature at the beginning of incubation was 6-12° C. In the winter temperature of 3-4° C was more favorable; there was a small decrease in the coldest period.

6125. Tiemeier, Otto W. (Dept. Zool., Kansas State Univ., Manhattan). 1962. INCREASING SIZE OF FINGERLING CHANNEL CATFISH BY SUPPLEMENTAL FEEDING. Trans. Kans. Acad. Sci. 65(2): 144-153; Biological Abstracts, Vol. 43, No. 1, Abst. No. 565. 1963.

During the summers of 1960 and 1961, fingerling channel catfish were fed dry pelleted feeds in ponds of 0.11 to 1.0 acre each. Stocking rates varied from 1,016 to 21,775 per acre. Recovery 5 to 10.5 months after stocking ranged from 955 to 20,425 per acre. Of the 11,048 fish stocked, 10,340 or 93.6% survived. Mean length and weight when removed in September and October was 8.6 inches and 85.1 grams. A gain of 1,638.1 pounds was obtained at an S conversion value of 3.73. Rates of gain varied from 331.3 to 2,240 pounds per acre. Cost of feed was 17.2 cents per pound of gain and 2.72 cents per fish. During July and August 71.9% of the total gain was achieved but poor growth was obtained after September 1. Lower stocking rates may not produce better growth than slightly higher rates. The results indicated that it was economically feasible to feed large numbers of fingerling channel catfish in small ponds through August and rear them to 8 or 10 inches long for stocking purposes. (Auth.)

6126. Irikhimovich, A. I., and A. M. Zelinin. 1961. DISTRIBUTION OF P^{32} IN THE TISSUES AND ORGANS OF MATURE MALE CARP AT DIFFERENT SEASONS OF THE YEAR. (RASPREDELENIE P^{32} V TKANYAKH I ORGANAKH POLOVOZRELYKH SAMOK KARPOV V RAXNYE SEZONY GODA.) Shtiintsa: Kishinev. 64-70; Referat. Zhur., Biol., 1962, No. 18I89; Biological Abstracts, Vol. 43, No. 1, Abst. No. 815. 1963.

Studies were made of the effects of seasonal variations of water temperatures on P metabolism in carp. Adult carp, 4-5 kg in weight, were injected with a solution of an inorganic P compound at a concentration of 20 microcuries of P^{32} per kg of body weight. Three series of experiments were conducted: winter (January to February), at a water temperature of 9° - 12° C; spring (April), water temperature 9° - 12°; summer (August), water temperature 21° - 25°. In winter, the greatest amount of radioactivity in most tissues (muscle, liver, skeleton, etc.) occurred on the 7th day after injection. Then it fell, although

rather slowly, particularly in gills and brain. At higher water temperatures (series 2 and 3) the metabolic rate increased, and the maximum amount of radioactivity was attained on the 2nd day after injection. Then the radioactivity began to fall. However, in roe, in April (intensive preparation of the gonads for ovulation) and in August (formation of the rd batch of roe) it continually increased. Its decrease in April was detected only 14 days after injection. Similar changes in radioactivity were observed in blood and brain. The greatest amount of activity was detected in the liver, and the greatest absorption of P^{32} in scales.

127. Malyarevskiya, A. Ya., and A. D. Dzyuban. 1962. BIOCHEMICAL CHARACTERISTICS, BLOOD PICTURE AND INDICES OF THE INNER ORGANS IN CARP UNDERYEARLINGS IN THE PERIOD OF HIBERNATION PREPARATION. (BIOKHIMISHESKIE POKAZATELI, KARTINA KROVI I INDEKSY VNUTRENNIKH ORGANOV U SEGOLETKOV KARPA V PERIOD PODGOTOVKI K ZIMOVKE.) Vysshaya Shkola: Moscow. 5: 125-126; Referat. Zhur., Biol., 1962, No. 20I76; Biological Abstracts, Vol. 43, No. , Abst. No. 824. 1963.

Samples were taken in September-October from ponds of the Kiev Oblast. In the period of preparing to hibernate, the carp underyearlings changed the direction of the metabolic processes, more intensively stored up fat and lowered the accumulation of N according to dry weight. In the period from September through October, an increase in dry weight was observed (in September, 20.52 - 28.64%, in October, 24.0 - 29.50%), a retention of fat in them (September 20.34, October 27.84%) and a lowering of N (September 7.66 - 8.45%, October 7.03 - 7.99%). The level of the total metabolism was not lowered.

128. Ostroumova, I. N. 1960. A PHYSIOLOGICAL EVALUATION, ON THE BASIS OF BLOOD INDICES, OF SALMON FRY CULTIVATED UNDER VARIOUS CONDITIONS. (FIZIOLOGICHESKAYA OTSENKA VYRASHCHENNOI V RAZNYKH USLOVIYAKH MOLODI SEMGI PO POKAZATELYAM KROVI.) Rybn. Khoz.: Moscow. 112-121; Referat. Zhur., Biol., 1962, No. 18I80; Biological Abstracts, Vol. 43, No. 1, Abst. No. 828. 1963.

Comparisons were made between the blood parameters of salmon fry and salmon yearlings cultivated on artificial and natural (pond) foods. Determinations were made on the percentage of Hb, number of erythrocytes, and rate of blood formation (according to the relative number of immature erythrocytes in the blood). Data were also obtained on the stability of erythrocytes in the presence of hypotonic solutions of NaCl and erythrocyte Hb (by means of the peroxidase reaction). The best parameters were obtained for fry and yearlings cultivated in ponds on natural foods. The Hb and erythrocyte levels of these fish were found to be similar to those of adult salmon. Poorest parameters were obtained for salmon fed fish meal and fish liver. In these fish, blood formation was inhibited. It is suggested that this condition may have resulted from a deficiency of vitamin B12 or Fe.

6129. Tarr, H. L. A. (Fish. Res. Bd. Canada, Vancouver, British Columbia, Canada). 1963. METABOLISM OF 6-PHOSPHOGLUCONIC ACID AND GLUCONIC ACID IN SALMO GAIRDNERII. Canadian Jour. Biochem. and Physiol. 41(2): 313-325; Biological Abstracts, Vol. 43, No. 1, Abst. No. 869. 1963.

$C^{14}O_2$ is formed 50 to 75 times as fast in Salmo gairdnerii (steelhead salmon) when uniformly labeled(U) C^{14} glucose is injected intraperitoneally or intramuscularly as when 6-phosphogluconic acid (6PG) is similarly administered. The rate of $C^{14}O_2$ formation is the same when fish are injected with C_1C^{14}-, C_6C^{14}-, or UC^{14}-6PG. Intramuscular or intravenous injection of C_6C^{14}-, C_6C^{14}-, UC^{14}-6PG, or UC^{14}-gluconic acid (GA) results in C^{14} labeling of "dextrin", maltose, glucose, G6P, F6P, FDP, and GA. On the contrary, maltose, glucose, and the hexosephosphates remain either non-radioactive, or have extremely low specific activity (SA), when fish are injected with C_1C^{14}-6PG. These facts are consistent with slow metabolism of 6PG via the HMP pathway in living fish. Since GA of fairly high SA is found in fishes injected with C^{14}-6PG and radioactive hexosephosphates are found in fish injected with C^{14}-GA, it is concluded that live fish can liberate orthophosphate from 6PG and phosphorylate GA. It is indicated that, at least until the rate of $C^{14}O_2$ formation from radioactive 6PG has been studied with tissues known to utilize either the HMP or the EMP pathways in glucose metabolism, no quantitative interpretation can be placed on use of such compounds in attempts to assess the comparative contributions of these two pathways in carbohydrate metabolism. (Auth.)

6130. Grajcer, Dov, and D. R. Idler (Fish. Res. Bd. Canada, Halifax, Nova Scotia, Canada). 1963. CONJUGATED TESTOSTERONE IN THE BLOOD AND TESTES OF SPAWNED FRASER RIVER SOCKEYE SALMON (ONCORHYNCHUS NERKA). Canadian Jour. Biochem. and Physiol. 41(1): 23-30; Biological Abstracts, Vol. 43, No. 1, Abst. No. 895. 1963.

Testosterone was isolated from the conjugated steroid fractions of both plasma and testes of spawning male sockeye salmon. The structure of the steroid was confirmed by several criteria, including infrared spectra. Glucuronoside conjugation was indicated by the use of a specific glucuronidase inhibitor, glucosaccharo-1, 4-lactone, and the inability of the enzyme to hydrolyze testosterone sulfate. (Authors)

6131. Vernidub, M. F. 1963. THE EXPERIMENTAL BASIS OF METHODS FOR ACCELERATING EMBRYONIC DEVELOPMENT IN THE GENUS SALMO AND ITS SIGNIFICANCE IN SALMON BREEDING. (EKSPERIMENTAL'NOE OBOSNOVANIE METODIKI USKORENIYA EMBRIONAL'NOGO RAZVITIYA LOSOSEI I EE ZNACHENIE V BIOTEKHNIKE

LOSOSEVODSTVA.) Vest. Leningradsk. Univ. Ser. Biol. 1. 7-22; Biological Abstracts, Vol. 43, No. 1, Abst. No. 2466. 1963.

The study of metabolism, growth rate, efficiency of yolk matter for the increase of the body weight and other processes in embryo, larvae, and fry of the genus Salmo from the North and Northwest of the USSR. Their development under the conditions of constant and gradually changing temperatures is studied. The optimal temperatures are established for morphogenesis and physiological processes within the embryonal period and for different stages of the larval period within which the yolk matter is most completely used for increasing the body weight. The change of metabolism is carried out under the conditions of varying temperatures (high and low ones). The consumption of the yolk matter for current needs of the organism increases. (Auth.)

6132. Fedorova, G. V. 1963. THE EFFECT OF SR-90 ON COREGONUS LAVARETUS LUDOGA EGGS AND LARVAE. (O DEISTVII SR-90 NA IKRU I LICHINKI SIGALUDOGI.) Vest. Leningradsk. Univ. Ser. Biol. 1. 48-53; Biological Abstracts, Vol. 43, No. 2, Abst. No. 4255. 1963.

Eggs and larvae of Coregonus lavaretus ludogo Pol accumulate Sr^{90} from water; the lower the radioactivity of water, the higher the accumulation. The larvae hatched from control eggs and from radioactive eggs which developed in water with the same radioactivity, survived 80-100% for 35 days. The destruction of larvae increased from 33% to 50% in the following 45 days in connection with the transition to independent feeding. (Auth.)

6133. Lebedeba, G. D. 1961. ACCUMULATION OF SR^{90} BY LEUCASPIUS SP. AND CARP FRY. (NAKOPLENNIE SR^{90} MAL'KAMI VERKHOVKI I KARPA.) Medgiz: Moscow. 319-322; Referat. Zhur., Biol., 1962, No. 18I90; Biological Abstracts, Vol. 43, No. 2, Abst. No. 4277. 1963.

In water with a specific activity of 1.4×10^{-6}, carp young and Leucaspius sp. accumulated significant amounts of Sr^{90} in the course of the first hour. At lower concentrations (1.4×10^{-8} - 1.4×10^{-10}) Sr^{90} uptake in measurable amounts was more protracted (4 - 14 days). Sr^{90} uptake was greater in water of low concentration than in that of high concentration. Carp fry accumulated Sr^{90} 10 times as fast as did carp yearlings.

6134. Podlipalin, Yu. D. 1962. THE ABILITY OF SOME BLACK SEA FISHES TO ORIENTATE TOWARDS THE SOURCE OF A SOUND. (SPOSOBNOST' NEKOTORYKH RYB CHERNOGO MORYA ORIENTIROVAT'CYA NA ISTOCHNIK ZVUKA.) Vopr. Ikhtiol. 2(4): 721-724; Biological Abstracts, Vol. 43, No. 2, Abst. No. 4324. 1963.

Attempts were made to condition the fishes Blennius sphinx L., Crenilabrus tinca (L.), C. griseus L., C. quinquemaculatus Block., Mullus barbatus ponticus L., Sargus annularis L., Spicara smaris (L.), Solea nasuta (L.) and Trachurus mediterraneus ponticus Aleev to orient towards a sound during feedings in aquaria. Of these, C. tinca, S. nasuta, and T. mediterraneus ponticus responded positively to sound when in natural conditions. Three species showed no conditioned or orientated response. (L. P.)

6135. Harris, John E. (Univ. Bristol, Bristol, England). 1963. THE ROLE OF ENDOGENOUS RHYTHMS IN VERTICAL MIGRATION. Jour. Mar. Biol. Assoc. U. Kingdom 43(1): 153-166; Biological Abstracts, Vol. 43, No. 2, Abst. No. 4416. 1963.

Photographic recording at hourly intervals of a group of animals controlled in a small tank kept in darkness demonstrated a 24 hr cycle of locomotor activity in Daphnia magna and Calanus helgolandicus. This rhythm is not determined by external stimuli and appears to be absent during the winter months. It provides a possible explanation for several features in the observed pattern of vertical migrations in natural conditions; the biological clock involved may be under some kind of hormonal control. (J. E. H.)

6136. Rudakov, N. P. 1961. THE ISOTOPE EFFECT IN THE DETERMINATION OF PRIMARY PRODUCTION OF ORGANIC MATTER IN WATERS BY THE RADIOISOTOPE METHOD. (IZOTOPNYI EFFEKT PRI OPREDELENII PER ICHNOI PRODUKTSII ORGANICHESKOGO VESHCHESTVA V VODOEMAKH RADIOIZOTOPNYM METODOM.) Minsk. 214-218; Referat. Zhur., Biol., 1962, No. 20Zh385; Biological Abstracts, Vol. 43, No. 2, Abst. No. 4424. 1963.

The necessity is indicated of considering the isotopic effect as a possible source of error in the evaluation of results of isotopic investigations in hydrobiology. In especially accurate investigations the thermodynamic isotopic effect must be taken into account, including the fact that because of differences in the zero energies of the isotopes with different masses, the equilibrium constants of the reactions are somewhat different than unity. The kinetic effects are of great importance. Other conditions being equal, the lighter isotopes react with greater rapidity. It is necessary to take into account the kinetic effect in the conduct of experiments with C^{14}. The present value of the photosynthetic isotopic effect taken as equal to 6-10%, should not be considered universal. This value can vary in wider limits, particularly with 24-hour or shorter exposures of the vials. The value of the photosynthetic isotopic effect must be determined in each concrete case. In order to calculate it the resultant formula $E_o = (1 - \frac{A}{A_o})$. 100% is proposed, where A_o = original specific activity, A = the specific activity of the reaction products.

6137. Datsko, V. G., and A. D. Semenov. 1961. FORECAST OF CHANGES IN MAGNITUDE OF PRIMARY PRODUCTION OF ORGANIC MATTER IN A RESERVOIR WHEN RIVER DRAINAGE IS REGULATED, USING THE AZOV SEA AS AN

EXAMPLE, AND ITS JUSTIFIABILITY. (PROGNOZ IZMENENII VELICHINY PERVICHNOI PRODUKTSII ORGANICHESKOGO VESHCHESTVA V VODOEME PRI ZAREGULIROVANII RACHNOGO STOKA NA PRIMERE AZOVSKOGO MORYA I EGO OPRAVDYVAEMOST'.) Gidrokhim. Materialy 33: 120-127; Referat. Zhur., Biol., 1962, No. 24Zh365; Biological Abstracts, Vol. 43, No. 2, Abst. No. 4520. 1963.

On the basis of data on dynamics of biogenic substance in the sea, and having assumed a magnitude equal to 8 for convertibility of P and N during the vegetation period, the authors have calculated approximately the production of phytoplankton in the presence of changes in the balance of biogenic substances. It is indicated that the presence of lowest total drainage of the rivers Don and Kuban' (22 km^3) the magnitude of phytoplankton production comprises 22-23 millions of metric tons during the second year of minimum drainage, as compared to 34 millions of metric tons during a medium drainage (42 km^3) year. Fluctuations in levels of phytoplankton production exert significant effects on the overall productivity of the sea and the development of the commercially valuable fish population in it. Variations in level of total run-off, which cause defined fluctuations in phytoplankton production, lead to corresponding changes in the abundance of plankton-eating fish. An evaluation is made of the correctness of forecasts of changes in levels of phytoplankton production, as issued prior to the regulation of Don River drainage. In accordance with results cited for subsequent studies, these forecasts were basically confirmed. Regulation of the Don drainage resulted in significant reduction of primary production in the Azov Sea. The authors consider as proven, in connection with the above, the presence of a direct relationship between the magnitude of production of organic substances and the income-outgo items of the biogenic element balance in a reservoir.

6138. Fel'dman, M. B., and A. V. Sukhovii. 1961. EFFECT OF MINERAL FERTILIZERS ON THE HYDROCHEMICAL CONDITION OF PONDS. (VLIYANIE MINERAL'NYKH UDOBRENII NA GIDROKHIMICHESKII REZHIM PRUDOV.) Minsk. 165-172; Referat. Zhur., Biol., 1962, No. 17Zh338; Biological Abstracts, Vol. 43, No. 2, Abst. No. 4531. 1963.

The authors studied the dynamics of biogenic substances (N and P) and the rate at which they were consumed in fish ponds. It was established that the smallest number of $PO_4^{\equiv}$ and NH_4^{+} ions from the slime went into solution at pH 6-7. Addition of acid, and especially of alkali to pH 8-9, increased the number of these ions going into solution. This explains the reaction of fertilizers when the ponds were limed. To increase the natural productive capacity of the fish, the authors recommend periodic addition (every day for a week) of N-P fertilizers. This controls the presence of biogenic substances in the ponds. From the standpoint of the productive capacity of the fish, best results were obtained with a P concentration of 0.5 mg/liter and a N concentration of 2.0 mg/liter.

6139. Khmeleva, N. N. 1961. COMPARATIVE DETERMINATION OF THE PRIMARY PRODUCTION OF PLANKTON IN PONDS OF THE LATVIAN SSR BY THE OXYGEN AND RADIO CARBON METHODS. (SRAVNITEL'NOE OPREDELENIE PERVICHNOI PRODUKTSIYA PLANKTONA V PRUDAKH LATVIISKOI SSR KISLORODNYM I RADIOUGLERODYM METODAMI.) Minsk. 209-213; Referat. Zhur., Biol., 1962, No. 20Zh451; Biological Abstracts, Vol. 43, No. 2, Abst. No. 4550. 1963.

The use of oxygen and radiocarbon methods for the determination of the primary production of fishery ponds in the Latvian SSR showed good similarity of the relative values according to the body of water and according to depth. In the majority of cases the primary production was higher in the bottom layer than in the surface layer: this difference was particularly great in a pond with a vigorous development of phytoplankton. The absolute values obtained by these or other methods did not always correspond. More often the oxygen method gave higher values than the isotope method, and only when the net production was positive according to oxygen, would the radiocarbon method give values similar to it. According to average values, the primary production of the plankton obtained by the radiocarbon method approached or coincided with values of the gross production determined by the oxygen method. Loss of C^{14} by phytoplankton during exposure in the dark averaged 18-20%.

6140. Lyakhnovich, V. P., R. M. Surinovich, and N. T. Kazanova. 1961. PRIMARY PRODUCTION OF PONDS AS AN INDEX OF THEIR FISH PRODUCTIVITY. (PERVICHNAYA PRODUKTSIYA PRUDOV KAK POKAZATEL' IKH YBOPRODUKTIVNOSTI.) Minsk. 133-138; Referat. Zhur., Biol., 1962, No. 20Zh452; Biological Abstracts, Vol. 43, No. 2, Abst. No. 4560. 1963.

The intensity of photosynthesis of plankton in ponds was measured by the vial method, which was established at various depths for 24 hours. At the same time, the composition and quantitative development of phytoplankton, filtered on membrane filters, was investigated. A large number of the investigated ponds was characterized by low values of photosynthesis intensity (1 mg/liter O_2) and the gross primary production on the average exceeded the destruction by only 20%. Such ponds, as a rule, continuously overgrown with aquatic vegetation, are located among marshes. The natural fish productivity did not exceed 70 kg/hectare.

6141. Mikheev, P. V., E. V. Meisner, and V. P. Mikheev (All-Russian Sci.-Res. Inst. Pond Fish., Moscow, USSR). 1962. THE ATTRACTION OF LIVING FOOD TO LIGHT. (PRIVLECHENIE ZHIVOGO KORMA RYB NA SVET.) Vopr. Ikhtiol. 2 (4): 731-739; Biological Abstracts, Vol. 43, No. 2, Abst. No. 4565. 1963.

Electric lights (60-150 watts) were suspended

above delineated enclosures in fresh-water ponds from May to August 1960-61. Crustacea were most readily attracted to light; Daphnia, Bosmina and Leptodora, respectively, were most intensely attracted to light, while Cyclopidae and Chydorus showed little attraction. The massing of light-orientated crustaceans lasted the entire night, and during the vegetation period of the year, more than 4 million were taken in a single night. Crustacea were taken under light in numbers roughly proportional to their actual frequency in the total pond plankton. Fish attracted to, and feeding on concentrated masses of crustaceans were conditioned to respond positively to light within a period of 1 - 15 days. Positively phototaxic fishes included the young and larvae of Cyprinus carpio, Carassius auratus and Lucioperca lucioperca. (L. P.)

6142. Agapov, I. D. 1961. INFLUENCE OF A FLUCTUATING LEVEL ON CONDITIONS FOR FISH REPRODUCTION IN RESERVOIRS. (VLIYANIE KOLEBANII UROVNYA NA USLOVIYA RAZMNOZHENIYA RYB V VODOKHRANILISHCHAKH.) Akad. Nauk SSSR: Moscow - Leningrad. 200-202; Referat. Zhur., Biol., 1962, No. 19I53; Biological Abstracts, Vol. 43, No. 2, Abst. No. 4616. 1963.

Highly changeable level and temperature regimes in reservoirs influence the natural reproduction of the fish stocks. For investigating the effectiveness of fish spawning in reservoirs, graphs of water level and temperature (ordinate) are plotted against season of the year. Times and temperatures at which 9 species of fish are known to spawn (elsewhere) are plotted as rectangles, the same for all graphs. Coincidence (or its lack) of these with observed temperatures in each particular year gives a basis for predicting spawning success, while the water-level line shows whether eggs may be dried out and how much feeding space the young fish will have.

6143. Kiselev, I. V. 1962. THE INFLUENCE OF ENVIRONMENTAL FACTORS ON GAMETES DURING OVULATION AND FERTILIZATION IN FISH AND THEIR EFFECT ON THE PROGENY. (VLIYANIE NA POTOMSTVO RYB SOSTOYANIYA GAMET, VYSVANNOGO DEISTVIEM FAKTOROV SREDY V PERIODY OVULYATSII I OSEMENENIYA.) Vysshaya Shkola: Moscow. 5: 95-97; Referat. Zhur., Biol., 1962, No. 19I55; Biological Abstracts, Vol. 43, No. 2, Abst. No. 4619. 1963.

A survey was carried out from 1957-1960 in ponds in Kiev Oblast and in aquariums at the Institute of Hydro-biology, Academy of Sciences, Ukrainian SSR. The objects of study were: Cyprinus carpio, Chinese Carassius carassius, Carassius carassius and females of carp hybrids. The effect of various concentrations of sperm (insufficient, normal and excess) of one species in the presence of sperm of another species was studied. The following were studied: the state of the spawn after its prolonged maintenance in the body cavity and outside the body cavity, the condition of the spawn and sperm caused by their contact with water before fertilization, the quality of the spawn and sperm in relation to the degree of maturity and physiological activity. An increase in the concentration of sperm had a positive influence on spawn fertilization, survival of embryos, larvae and fry, on the rate of development and hatching of embryos, and on growth of the fish. An excess had a negative influence. The sperm of taxonomically related species increased the spawn fertilization and embryo survival. Lengthy retention of the spawn in the body cavity after ovulation sharply reduced the spawn fertilization.

6144. Malikova, E. M. 1962. BIOCHEMICAL CHANGES IN THE BODIES OF YOUNG SALMON (PISCES) DURING THEIR DOWNSTREAM MIGRATION. (BIOKHIMICHESKIE IZMEMENIYA ORGANIZMA MOLODI LOSOSYA PRI PEREKHODE V POKATNOE SOSTOYANIE.) Akad. Nauk SSSR: Moscow and Leningrad. 100-104; Referat. Zhur., Biol., 1962, No. 20I79; Biological Abstracts, Vol. 43, No. 2, Abst. No. 6144. 1963.

The transfer of young salmon into the downstream migrant state was connected with the sharp decline of fat and increase in the amount of proteins and minerals. The quantitative ratio of amino acids in the protein molecule of the organism fluctuated. With the approach of silvering, the methionine, tryptophan and histidine content of the protein rose, and cystine, tyrosine and arginine content decreased. The large expenditure of fat supply was simultaneous with the maximal morphological changes, and was characteristic of the mobilization of all inner resources for organism rebuilding in connection with the transfer to life in new environmental conditions.

6145. Olivereau, Madeleine (Lab. Physiol., Inst. Oceanogr., Paris, France). 1962. INTERRÉNAL (ADRENAL) MODIFICATIONS OF THE SMOLT (SALMO SALAR L.) WHEN CHANGED FROM FRESH TO SEA WATER. (MODIFICATIONS DE L'INTERRENAL DU SMOLT (SALMO SALAR L.) AU COURS DU PASSAGE D'EAU DOUCE EN EAU DE MER.) Gen. and Comp. Endocrinol. 2(6): 565-573; Biological Abstracts, Vol. 43, No. 2, Abst. No. 5422. 1963.

The immersion of smolt in sea water provokes a rapid decrease of vacuolization in interrenal cells, and in their content of lipid and phospholipid. The most usual structure of this tissue is glomerular. A statistically significant hypertrophy of interrenal tissue persists for at least 14 days, but the cytologic reactions diminish. The normally observable cellular degeneration is not expressed. The motor activity of the treated smolt remains normal, but the stress of changing aquariums may alter this initially. In its duration the observed response may be interpreted as one of the features of osmoregulation incident to passage into sea water. (Auth.)

6146. Thornburn, C. C., and A. J. Matty (Gatty Mar. Lab., Univ. St. Andrews, Scotland). 1963.

THE EFFECT OF THYROXINE ON SOME ASPECTS OF NITROGEN METABOLISM IN THE GOLDFISH (CARASSIUS AURATUS) AND THE TROUT (SALMO TRUTTA). Comp. Biochem. and Physiol. 8(1): 1-12; Biological Abstracts, Vol. 43, No. 2, Abst. No. 5533. 1963.

The ammonia production of goldfish immersed in thyroxine solution increased markedly at 21° C, though there was no effect at 14° C. The total nitrogen excreted was about 75% ammonia. Thyroxine had no effect on the nitrogen excretion of trout at 14° C. Immersion of goldfish in thyroxine for 9-14 days produced an increase in free amino acid in liver and in muscle, no change in muscle keto acids, and a decrease in muscle creatine. The ammonia production of isolated goldfish gills incubated in tap water was increased 13.9% whereas that of gills incubated in buffer and in saline was not significantly altered. Pretreatment with thyroxine in vivo gave a similar effect, but an amino acid substrate was necessary for it to occur. The ammonia production of trout gills was not significantly altered by thyroxine. There was no difference in the respiration rates of thyroxine-treated and untreated isolated gills. Goldfish muscle homogenate treated with thyroxine in vitro showed an 18% greater uptake of 1-^{14}C-DL-leucine than the untreated. Liver homogenate showed no difference. (Authors)

6147. Anonymous. 1963. PROCEEDINGS OF THE WORLD SCIENTIFIC MEETING ON THE BIOLOGY OF TUNAS AND RELATED SPECIES. FAO Fisheries Reports No. 6, Vol. 3, 875 pp.

This volume contains ten Methodological and forty-seven Experience Papers which were distributed to the participants and to the contributors of the World Scientific Meeting on the Biology of Tunas and Related Species, in La Jolla, California, 2-14 July 1962.

6148. Chouinard, L. A. (Dept. of Anat., Faculty of Medicine, Laval Univ., Quebec City, Quebec, Canada). 1963. SITES OF FORMATION OF THE EXTRA NUCLEOLI DURING EARLY OOCYTE GROWTH IN THE FRESH-WATER TELEOST SALVELINUS FONTINALIS MITCHILL. Canadian Journal of Zoology, Vol. 41, No. 6, pp. 997-1010.

The behavior of nuclear structures during early oocyte growth in Salvelinus fontinalis is described with special attention focused on the sites at which the extra nucleoli first appear. In the species investigated, the process of extra nucleoli formation begins at about the mid-pachytene stage of meiotic prophase and proceeds in an uninterrupted fashion until the late strepsitene stage is reached; during that period of time, close to a 150 extra nucleoli form within the nuclear cavity. From the mid-pachytene up to about the mid-strepsitene stage, our observations suggest that, while some of the extra nucleoli arise by successive growth and detachment from a single large heterochromatic body adjacent to the oocyte's original nucleolus, the others develop in contact with minute chromocenters located in the peripheral portion of the nuclear cavity. The relevant observational evidence would seem to favor the view that the heterochromatic body adjacent to the oocyte's original nucleolus contains one of the four alleged pairs of nucleolar organizing regions of the usual nucleolar chromosomes. During the mid-strepsitene stage, on the other hand, our observations reveal that, while the heterochromatic body and the chromocenters disappear from view, additional extra nucleoli develop at various points along the length of a number of chromosomes. These observations are taken to indicate that non-heterochromatic chromosomal regions distinct from the nucleolar organizing regions of the usual nucleolar chromosomes are, during that period of meiotic prophase, instrumental in the formation of extra nucleoli. The significance of the above findings is discussed in relation to the observations of other workers on the sites of formation of nucleoli in general. (Auth.)

6149. Hoar, W. S., and J. G. Eales (Dept. of Zool., Univ. of British Columbia, Vancouver, British Columbia, Canada). 1963. DEPENDENCE OF CONVERSION RATIO ON THE DOSE OF RADIOIODINE IN FISH. Canadian Journal of Zoology, Vol. 41, No. 6, pp. 1061-1068.

Goldfish at 20° C showed a correlation between the 4-day conversion ratio (CR) and dose of I^{131} over a dose range of 1.1 to 8.2 μc/gram body mass. Other aspects of I^{131} metabolism did not correlate with dose. Chum salmon at 12° C also showed a correlation between CR and dose over a comparable range but goldfish (4° C), chub (4° and 20° C), steelhead trout (4° C), and sockeye salmon (4° C) showed no dependence of CR on I^{131} dose. Goldfish were unique among these species in possessing ruptured follicles and blood cells in the colloid. Ruptured follicles were also present in uninjected fish and there was no evidence to relate rupturing of follicles with dose-dependence of the CR. (Authors)

6150. Mackiewicz, John S. (Dept. of Biol., State Univ. of New York at Albany, Albany). 1963. MONOBOTHRIUM HUNTERI SP. N. (CESTOIDEA : CARYOPHYLLAEIDAE) FROM CATOSTOMUS COMMERSONI (LACÉPÈDE) (PISCES : CATOSTOMIDAE) IN NORTH AMERICA. The Journal of Parasitology, Vol. 49, No. 5, pp. 723-730.

Monobothrium hunteri sp. n. (Cestoidea : Caryophyllaeidae) is described from Catostomus commersoni (Lacépède) in four states. The adult is described, and a table comparing the four species of Monobothrium is given. The systematics of the genus are briefly discussed and the literature records of M. ingens Hunter are reviewed. The life cycle is unknown. (Auth.)

6151. Self, J. Teague, Lewis E. Peters, and Clarence E. Davis (Univ. of Oklahoma Biological Sta., Norman). 1963. THE EGG, MIRACIDIUM, AND ADULT OF NEMATOBOTHRIUM TEXOMENSIS (TREMATODA : DIGENEA). The Journal of Parasitology, Vol. 49, No. 5, pp. 731-736.

Nematobothrium texomensis occurs primarily in the gravid ovaries of three species of buffalo fishes. The adult is extremely filamentous, attaining a length of up to 2.5 m. It is almost devoid of muscle tissue, capable of little movement, and presumably absorbs nourishment through the cuticle. All sex organs are tubular. The ventral sucker is poorly developed and not recognizable in most specimens.

There is evidence that when fish hosts spawn, pieces of worms containing eggs are discharged. Development outside the host is unknown except that miracidia force-hatched from the operculate eggs are of the didymozoid type. Development of N. texomensis is associated with the reproductive cycle of the host and the worm has never been found in a sexually immature fish. The worms die when the fish spawn or begin to resorb unspawned eggs.

Eggs do not hatch in the juices of any snail species indigenous to Lake Texoma. Although some hatched in the gut of Succinea avara, no larvae developed. (Authors)

6152. Hoffman, Glenn L., and Clarence E. Dunbar (Bur. Sport Fish. & Wildl., Eastern Fish Disease Lab., Kearneysville, West Virginia). 1963. STUDIES ON NEOGOGATEA KENTUCKIENSIS (CABLE, 1935) N. COMB. (TREMATODA : STRIGEOIDEA : CYATHOCOTYLIDAE). The Journal of Parasitology, Vol. 49, No. 5, pp. 737-744.

The cercaria of N. kentuckiensis was found in Anaplocamus dilatatus (Nitrocris d.) and Mudalia carinata. The metacercaria was found in all fishes examined from Opequon River, West Virginia, except Cottus bairdi which was also refractory to experimental infection.

Two species of Centrarchidae, four of Cyprinidae, three of Salmonidae, Etheostoma flabellare, Platypoecilus maculatus, and Trichogaster trichopterus were experimentally infected. The development of the metacercaria and cyst and effect on the fish are described.

The histopathology initially consists of hemorrhage and muscle necrosis about the metacercaria, followed by reorganization and formation of a loose connective tissue cyst.

The controversial adult names are discussed and an emendation of the genus Neogogatea is presented.

6153. Klement, Alfred W., Jr., and Vincent Schultz (Div. of Biol. and Med., Atomic Energy Comm., Washington, D. C.). 1963. TERRESTRIAL AND FRESH-WATER RADIOECOLOGY. A SELECTED BIBLIOGRAPHY (SUPPLEMENT 1). Atomic Energy Comm., TID-3910 (Suppl. 1), 95 pp.

Compilation of this first supplement is based on the same criteria as was TID-3910. Publications since March 1962 and a number of those prior to that time which came to the authors' attention are included.

6154. U. S. Atomic Energy Comm. (Div. of Tech. Information, Washington 25, D. C.). 1963. OFFSITE ECOLOGICAL RESEARCH OF THE DIVISION OF BIOLOGY AND MEDICINE - TERRESTRIAL AND FRESH-WATER. Atomic Energy Comm., TID-13358 (1st Rev.), 122 pp.

This revised booklet on terrestrial and freshwater ecology is one in a series of such publications to describe research programs supported by the Division of Biology and Medicine, U. S. Atomic Energy Comm. Fresh-water research projects described include nuclide uptake by algae and zooplankton, fates and effects of radionuclides in aquatic food chains, a study of phosphorus cycling and productivity in a stream ecosystem, and laboratory studies on the effect of radium on aquatic organisms.

6155. Crutchfield, James (Dept. of Economics, Univ. of Washington, Seattle), and Arnold Zellner. 1962. ECONOMIC ASPECTS OF THE PACIFIC HALIBUT FISHERY. U. S. Fish and Wildlife Serv., Fishery Industrial Research, Vol. 1, No. 1, 174 pp.

Under international regulation by the Canadian and United States Governments, the Pacific halibut fishery, which once faced depletion, has been restored to a high level of productivity. Although the stocks of halibut now are adequately protected, economic weaknesses in the fishery prompted the study reported here.

This report discusses the basic theory of the regulation, analyzes its economic effects, and presents the conclusions drawn from the analysis and their implications for public policy. (Authors)

6156. Kinney, Edward C. (Bur. Sport Fish. and Wildl., Washington, D. C.). 1963. ANNUAL REPORT FOR 1962, FISHERY MANAGEMENT SERVICES. U. S. Fish and Wildlife Service, Br. of Fish. Mgmt. Svcs., 34 pp.

A total of 530,036 acres of lakes and ponds, and 4,222 miles of streams located on lands held by Federal agencies are under management.

Approximately 5,215 acres of lakes and ponds and 591 miles of streams were reclaimed or improved and 2,844 acres of new water was created. More than 2,900,000 man-days of angling were made available on these waters during 1962.

6157. Girsa, I. I. (Inst. Animal Morphol. Acad. Sci. USSR, Moscow). 1962. THE EFFECT OF VARIATIONS IN ILLUMINATION ON THE ACCESSIBILITY OF FOOD ORGANISMS TO PREDATORY FISH OF VARIOUS ECOLOGIC GROUPS. (VLIYANIE IZMENYAYUSHCHEISYA OSVESHCHENNOSTI NA DOSTUPNOST' KORMOVYKH ORGANIZMOV DLYA KHISHCHNYKH RYB RAZNYKH EKOLOGICHESKIKH GRUPP.) Voprosy Ikhtiol. 2(1): 183-191; Biological Abstracts, Vol. 43, No. 2, Abst. No. 8329. 1963.

Illumination experiments were carried out at the aquarium of the Moscow Zoo on 5 predators

belonging to different systematic groups but similar in their feeding ecology. In a series of 24 experiments on the catfish (Silurus glanis L.), a typical nocturnal predator, the incident illumination was varied from 0 to 200 lux. The catfish became active and began to explore the whole tank and feed only at very low illuminations (below 0.0001 lux) or in complete darkness. In the presence of light, it sometimes swam around, but was more apt to remain immobile, making no attempt to seize its prey (Leucaspius sp.). At 0.0001 lux, on the other hand, an average of 30% of the available victims were consumed within 20 minutes, and at 0 lux, 80-100% were eaten within 30-60 minutes. In experiments on two eels (Anguilla anguilla L.), using young roach (Rutilus rutilus L.) as the prey, swimming and feeding occurred only in the dark, some of the roach being captured at an illumination of 0.001 lux. In the presence of light, the eels usually remained quiet, buried in the sand; they consumed fry which swam close to them, but never pursued free-swimming fish. In experiments with two specimens of Corvina nigra L., Atherina fry were used as the test prey. When it was light, the predators usually stayed quietly in the darkest corners of the tank or occasionally swam around slowly. When the Atherina fry were introduced, they grew animated and chased the fry persistently, with results which depended on the defensive maneuvers of the prey. Thus, only 3 out of 13 attacks on massed fry were successful, while almost all of the fry were consumed when they remained separated. In the dark, the predators were more successful, the percentage of fry consumed increasing with decreasing illumination from 20% at 1000 lux to 60-100% at 0 lux. In experiments with cod (Gadus morhua L.), conducted in a huge experimental vat along the shore, and using yearling cod and herring as the prey, the average percentages of young cod consumed ranged from 20% in 60 minutes at 0 lux to 100% in 15 minutes at 10-1000 lux; 65% of the young herring were eaten within 60 minutes at 0 lux, 90% within 20 minutes at 0.01 lux, 40% within 3 minutes and 100% within 12 minutes at 1000 lux. Here again, the luck of the predator depended on the behavior of the prey at different illuminations, i.e., on whether they were concentrated or scattered. Blinded cod and intact cod illuminated only with the long-wave portion of the red spectrum--visible to humans but not to cod--seized their prey only when it made contact with their snout or barbs. Thus, the role of vision in the feeding behavior of cod is more important than some have contended. In experiments on two perch (Perca fluviatilis L.), with Leucaspius as the prey, the percentage eaten at 100 lux was 100% in 15 minutes when the victims approached the location of the perch, 0% in 120 minutes when they remained at a distance. At 0 lux, no prey were taken in 60-minute experiments carried out in the first two months, but after this, perch were able to seize 20-40% of their prey within 15 minutes--apparently as a result of extinction of the defensive reaction observed in perch in the dark hours of the day, so that they were now able to make good use of their sensory organs for feeding. The author concludes that the degree of accessibility of food organisms to predatory fish changes with the illumination and time of day and depends on the critical ability of the receptors and on the specific adaptive behavior of the fishes directed toward the preservation of the species. (F. X. K.)

6158. Magnin, E. (Lab. Zool., Lyon, France), and G. Beaulieu. 1963. COMPARATIVE MORPHOMETRIC STUDY OF ACIPENSER OXYRHYNCHUS MITCHILL OF THE SAINT LAWRENCE RIVER AND A. STURIO OF THE GIRONDE RIVER. (ETUDE MORPHOMETRIQUE COMPAREE DE L'ACIPENSER OXYRHYNCHUS MITCHILL DU SAINT-LAURENT ET DE L'ACIPENSER STURIO LINNE DE LA GIRONDE.) Nat. Canadien 90(1): 1-38; Biological Abstracts, Vol. 43, No. 2, Abst. No. 8335. 1963.

Regression equations expressing variations of 21 body measurements in comparison with either total body length or length of the head were computed for 80 A. sturio and 480 A. oxyrhynchus specimens. It is concluded that these are indeed 2 different species. (G. R. B.)

6159. Simon, Raymond C. (Coll. Fish., Univ. Washington, Seattle). 1963. CHROMOSOME MORPHOLOGY AND SPECIES EVOLUTION IN THE FIVE NORTH AMERICAN SPECIES OF PACIFIC SALMON (ONCORHYNCHUS). Jour. Morphol. 112(1): 77-97; Biological Abstracts, Vol. 43, No. 3, Abst. No. 8460. 1963.

Samples of ova were obtained from ten females of each species of Oncorhynchus native to North America. These ova were fertilized, then incubated for varying lengths of time dependent upon species and temperature. Blastodiscs were prepared by the squash method and stained with aceto-orcein. Chromosomes were counted in at least two blastulae from each sample. A minimum of five chromosome sets in each species was studied to determine gross chromosome morphology. Diploid chromosome numbers were found to be constant, with few exceptions, within a species. Somatic chromosome numbers range from 74 in the chum salmon, to 52 in the pink salmon. The diploid chromosome number was found to be different in each of the species studied. No difference was found in the number of chum salmon chromosomes in material obtained from Japan, and from the United States. Evolution of the species of Oncorhynchus has been considered. No evidence has been found which would indicate that polyploidy could account for differences in chromosome numbers of the species studied. This study reveals that Robertson's law explains the mechanism by which chromosome numbers have apparently changed. It is highly likely that centric fusions have been largely responsible for differences in chromosome numbers of the five species. Confusions are discussed regarding the correct chromosome numbers in several salmonids. Morphologically-distinct sex chromosomes are not evident in the species of

Oncorhynchus studied. (Auth.)

6160. Protasov, V. R., and Yu. P. Altukhov. 1961. THE NATURE AND MECHANISM OF FISH REACTIONS TO ARTIFICIAL LIGHT. (PRELIMINARY REPORT.) (O PRIRODE I MEKHANIZME REAKTSII RYB NA ISKUSSTVENNYI SVET. (PREDVARIT. SOOBSHCHENIE.)) Tr. Karadagsk. Biol. Sta. Akad. Nauk Ukrain. SSR. 17. 3-6; Referat. Zhur., Biol., 1963, No. 2I92; Biological Abstracts, Vol. 43, No. 3, Abst. No. 8578. 1963.

The movement of fish toward light is composed of two phases: formation of small masses at a distance from the light source, and their subsequent progress into the illuminated zone. It was considered that the basis of the biological nature of the positive reaction of fish to artificial light is the necessity to form schools, and the alimentary reflex was examined as a special case of the phenomenon. The illumination in this area approaches that required for the formation of schools in slighted gregarious fish reacting positively to light. The authors explain in terms of visual adaptations the movement of fish into the zone of most intense illumination.

6161. Voronin, L. G., and Yu. A. Kholodov. 1962. METHODS OF EXPERIMENTAL STUDIES OF FISH BEHAVIOR. (METODIKA EKSPERIMENTAL'NOGO IZUCHENIYA POVEDENIYA RYB.) Akad. Nauk SSSR: Moscow. 224-241; Referat. Zhur., Biol., 1962, No. 1I60; Biological Abstracts, Vol. 43, No. 3, Abst. No. 8585. 1963.

Methods of studying conditioned reflexes in fish are presented. These methods involve the study of motor activity, response to electric current, response to light, "preference" reactions, and motor reflexes. Conditioned-reflex components of behavior are presented by descriptions of electrodefensive and feeding techniques. Complex behavior is represented by a description of the maze method. Experimental techniques and procedures for recording of data are described.

6162. Azbelev, V. V. 1962. SPAWNING MIGRATION OF PINK SALMON (ONCORHYNCHUS GORBUSCHA) IN 1961.) (NERESTOVAYA MIGRATSIYA GORBUSHI V 1961.) Nauchn.-Tech. Byul. Polyarnogo Nauchn.-Issled. i Proektnogo Inst. Morskogo Rybn. Khoz. i Okeanogr. 1. 19. 16-18; Referat. Zhur., Biol., 1962, No. 24I85; Biological Abstracts, Vol. 43, No. 3, Abst. No. 8641. 1963.

The first catch along the shore of the Kola Peninsula was on June 23rd. The quantity and distribution of pinks in the various rivers in 1960 and 1961 was completely different. The total number was considerably less in 1961 than in 1960, although the northern hatcheries released approximately the same number of young in 1959 and in 1960. Probably this happened as a result of the different conditions in the feeding places of these generations. It is also assumed that these two generations fed in different parts of the sea. The size of the fish in 1960 (the year with a large number) was greater than in 1961. In the Far East the reverse relationship is observed between the abundance and length.

6163. Bocharov, G. D. 1962. ACTIVE SELECTION OF SEA WATER BY YOUNG PINK SALMON (ONCORHYNCHUS GORBUSCHA WALB.). (OB AKTIVNOI IZBIRATEL'NOI REAKTSII MOLODI GORBUSHI (ONCORHYNCHUS GORBUSCHA WALB.) PO OTNOSHENIYU K MORSKOI VODE.) Referat. Zhur., Biol., 1962, No. 23I80; Biological Abstracts Vol. 43, No. 3, Abst. No. 8645. 1963.

Downstream migrants, kept for one month in fresh-water, exhibited a positive selective reaction to salty water. Rapid formation of a conditioned reflex occurred at the spot where salt water was introduced. Positive reaction was formed at temperatures not lower than 11° C.

6164. Bocharov, G. D. 1961. SURVIVAL OF YOUNG PINK SALMON (ONCORHYNCHUS GORBUSCHA WALB.) IN RELATION TO THE METHODS OF TRANSFER FROM FRESH WATER TO THE SEA. (VYZHIVAEMOST' MOLODI GORBUSHI (ONCORHYNCHUS GORBUSCHA WALB.) V ZAVISIMOSTI OT SPOSOBOV PEREVODA IZ PRESNOI VODY V MORSKUYU.) Tr. Murmansk. Morskogo Biol. Inst. 8. 7. 83-90; Referat. Zhur., Biol., 1962, No. 24I49; Biological Abstracts, Vol. 43, No. 3, Abst. No. 8646. 1963.

With the simultaneous transfer of humpbacked salmon young in the stage of resorption of the yolk sac and of Argentina silus fingerlings into water with a salinity up to 23.3°/oo, survival was 94-98%. A similar high survival in sea water with a salinity of 33.3°/oo could be achieved after adaptation of the fingerlings to a solution with 13.3°/oo salinity and 23.3°/oo in the course of 2 days. Fingerlings at the end of the period of yolk sac resorption and at the beginning of silvering adapted better to the change of salt regime, and also were more resistant to the lethal concentration of salt in comparison with A. silus fingerlings which were held back for 1 1/2 months in fresh water. The preliminary adaptation of the fingerlings to a salinity of 33.3°/oo increased their resistance to lethal concentrations. In the downstream migration stage, the young did not tolerate sharp fluctuations of salinity.

6165. Burmakin, E. V. 1961. ABSOLUTE NUMBERS OF PERCH AND THEIR TOTAL WEIGHT IN SMALL LAKES. (ABSOLYUTNAYA CHISLENNOST OKUNYA I EGO IKHTIOMASSA V MALYKH OZERAKH.) Tr. Soveshchanii Ikhtiol. Komis. Akad. Nauk SSSR 13. 235-237; Referat. Zhur., Biol., 1962, No. 20I33; Biological Abstracts, Vol. 43, No. 3, Abst. No. 8649. 1963.

The total poisoning of fish by polychloropinene in two lakes in Pskov Oblast, populated only by perch, was studied. The weight of dead fish in Lake Okunevetz was 43.4 kg/hectare, and in Lake Plavushch 41.3 kg/hectare.

6166. Dement'eva, T. F. 1962. CHANGES IN BIOLOGICAL CHARACTERISTICS OF FISH POPULATIONS AND SIGNIFICANCE OF THESE CHANGES IN FORECASTING CATCHES. (IZMENENIYA BIOLOGICHESKIKH SVOISTV POPULYATSII RYB I ZNACHENIE ETIKH IZMENENII PRI RASCHETE PROMYSLOVOGO PROGNOZA.) Kievsk. Univ.: Kiev. 4: 22-25; Referat. Zhur., Biol., 1962, No. 23I41; Biological Abstracts, Vol. 43, No. 3, Abst. No. 8656. 1963.

Change in biological factors which are mainly connected with diet results in changes of growth rate, maturation, and fecundity, which determine the dynamics of population structure. Determination of the amount of replenishment derived from fish reaching maturity first, provides a basis for estimating catch. This can be accomplished by estimating the quantity of fry and by computing growth rate of fish from the first year of life to sexual maturity, for the more rapid the growth-rate, the earlier the appearance of maturity. Frequently, unfavorable conditions cause sexual maturity to occur at an early age and reduced size. In every case it is necessary to ascertain the factors responsible for change in growth rate; these factors are usually associated with quantity of food and its availability, as well as with the number of consumers, with temperature changes, and changes in metabolic processes.

6167. Domanevskii, L. N. 1962. SIZE OF PREY ACCESSIBLE TO PIKE. (DOSTUPNYI RAZMER ZHERTV DLYA SHCHUKI.) Byul. Inst. Biol. Vodokhran. Akad. Nauk SSSR 12. 50-53; Referat. Zhur., Biol., 1962, No. 23I64; Biological Abstracts, Vol. 43, No. 3, Abst. No. 8657. 1963.

This paper establishes the relationship between the sizes of pike (Esox lucius) and the sizes of various fish species devoured by them. Because the predator population is generally made up of older fish, no fresh-water fish is able to avoid being directly affected by the pike population.

6168. Domanevskii, L. N. 1962. FEATURES OF THE ECOLOGICAL RELATIONS BETWEEN THE PIKE AND THE IMPORTANT FISHES OF THE TSIMLYANSK RESERVOIR. (OSOBENNOSTI EKOLOGICHESKIKH VZAIMOO TNOSHENII SHCHUKI I OSNOVNYKH RYB V TSIMLYANSKOM VODOKHRANILISHCHE.) Vysshaya Shkola: Moscow. 5: 53-54; Referat. Zhur., Biol., 1962, No. 19I69; Biological Abstracts, Vol. 43, No. 3, Abst. No. 8658. 1963.

The influence of Esox on the population of one or another fish was determined by the ecological proximity of fish, prey and predators, by the coincidence of areas of their feeding in various seasons of the year, and also by the rhythm of the annual life cycle.

6169. Evropeitseva, N. V. 1960. EXPERIENCE IN THE POND BREEDING OF THE YOUNG OF ATLANTIC, BALTIC, AND LAKE SALMON UNTIL THE MIGRATORY STATE. (OPYT PRUDOVOGO VYRASHCHIVANIYA MOLODI SEMGI, BALTIISKOGO I OZERNOGO LOSOSEI DO POKATNOGO SOSTOYANIYA.) Rybnoe Khoz.: Moscow. 20-30; Referat. Zhur., Biol., 1962, No. 20I87; Biological Abstracts, Vol. 43, No. 3, Abst. No. 8663. 1963.

The raising of the water temperature in ponds of the "Pelchi" fish hatchery in April-May up to 10-13° C caused a reduction in the growth rate and survival. Among the young salmon with a decreasing growth rate, males predominated (62%) and an increase in development of the sex glands was noted in 40% of them. About 1/5 of the salmon underyearlings at 5 months of age had an average weight of 10 g. The average weight of the Baltic salmon at the age of 5.5 months was 15.3 g. In the course of 210 days the average weight of the lake salmon rose 153%, of Baltic salmon 78%, Varzugsk salmon 88%, and Kol'sk salmon 57%. In the pre-spring months, a rise in the intensity of growth was observed which was related to the rising temperature in the ponds. The process of smoltification took place in the beginning of the 2nd year of life. A greater speeding up of smoltification in comparison with the natural conditions was observed in salmon (in 1 - 1 1/2 months) and in Baltic and lake salmon 2 weeks earlier. In the pond conditions, spermatogenesis took place in the Baltic salmon dwarf males in the 2nd year and began 2 1/2 - 3 months earlier than in natural conditions. Only 2 - 8% of all the males matured at this age, reaching or exceeding the size for smoltification. In the majority of males, the intensification of growth and development ended at the stage of transfer to life in the sea.

6170. Fortunatova, K. R. 1961. THE INFLUENCE OF PREDACEOUS FISH ON THE POPULATION STRUCTURE OF USEFUL FISHES. (O KHARAKTERE VOZDEISTVIYA KHISHCHNYKH RYB NA STRUKTURU POPULYATSII PROMYSLOVYKH RYB.) Tr. Soveshch. Ikhtiol. Komissii Akad. Nauk SSSR 13. 108-116; Referat. Zhur., Biol., 1962, No. 16I51; Biological Abstracts, Vol. 43, No. 3, Abst. No. 8665. 1963.

In the southern seas of the European part of the USSR the basic food of predaceous fishes are small organisms with a short life cycle and high reproductive capacity. The effect of the predators on them is similar to the effect of a fishery. When feeding on larger organisms with a longer life cycle, the effect of predators is opposite to the effect of a fishery, because it eliminates from the body of water the smallest members of the mature stock. The more intensive the fishing for a given species of fish, the greater the difference in the sizes obtained by fishing and those consumed by fish. As numbers of the older ages of this species decreased, predators switch to fish of younger age groups, or even to their own young. This is a forced and temporary expedient. The exception was the considerable consumption of young carp by predators in June-July on the Volga delta, which was dependent upon their considerable concentration at the time of fall in water level. During stable, historically-recorded conditions in bodies

of water when fishing was less intensive, the influence of the relatively small numbers of predators on the composition and quantity of the fish was not significant.

6171. Grimal'skii, V. L., and S. N. Tyutyunik. 1961. EFFECT OF LOW STOCKING DENSITIES ON THE FOOD AND GROWTH OF CARP. (VLIYANIE RAZREZHENNYKH POSADOK NA PITANIE I ROST MOLODI KARPA.) Tr. Kishinevsk. Sel'sko-Khoz. Inst. 25: 121-132; Referat. Zhur., Biol., 1962, No. 23I100; Biological Abstracts, Vol. 43, No. 3, Abst. No. 8669. 1963.

An experiment is described on annual breeding of commercial carp in 2 ponds of 0.4 and 0.5 ha in area, respectively. Detailed data on the chemical composition of water, on plankton and benthos in the experimental ponds are presented. Stocking density was 3200 and 3250 young fish per hectare. After 4 months, fingerlings in the experiment in which oil cake was added averaged 411 g, and, in the experiment without oil cake, 340 g, fish production being correspondingly 865 and 763.6 kg/ha. It was noted that attenuated stocking leads to underexploitation of food resources of the waters. For this reason the author recommends adoption of mixed stockings.

6172. Ivlev, V. S. 1961. ATTEMPTS TO EVALUATE ENERGY UTILIZATION IN ONE LINK OF THE FOOD CHAIN. (OPYT OTSENKI UTILIZATSII ENERGII V ODNOM ZVENE PISHCHEVOI TSEPI.) Minsk. 374-380; Referat. Zhur., Biol., 1962, No. 18I40; Biological Abstracts, Vol. 43, No. 3, Abst. No. 8675. 1963.

The article describes attempts to evaluate the utilization of energy in one link of the food chain (i. e. plankton-fish), including calculations of energy supply in the form of food and its consumption during metabolic processes. It is shown that daily growth of fish in calories $Q' = 0.8\ R_c - 24Q_s - (Q+Q_s)\frac{R_c}{R}$, where R_c is the maximum daily ration, R is the maximum individual ration, Q_s is the basal metabolism and Q is the total metabolism. The period of time over which a fish receives its daily ration in the process of feeding

$$a = \frac{R_c\ (1 - 10^{-\beta p})}{R\ (1 - 10^{-\beta p})},$$

where p is the concentration of food, β is the coefficient of proportionality. A basis has been developed for the application of a new indicator, the coefficient of consumption, which represents the relation of the quantity of potentially consummable prey to the actual requirement

$$\epsilon = \frac{R\ (1 - 10^{-\beta p})}{\pi p^2 v P}$$

where p is the distance at which the fish can capture its prey without elongation of its hunting path and v is the speed of its movement. The use of larger prey is more convenient from the standpoint of energy where the fish feeds on organisms of varying size, since the linear distribution of prey equals $1/\sqrt[3]{P}$.

6173. Ivlev, V. S. 1961. A METHOD OF EVALUATING FOOD RATIONS FOR FISH. (METOD OTSENKI OBESPECHENNOSTI RYB PISHCHEI.) Tr. Soveshchanii. Ikhtiol. Komis. Akad. Nauk SSSR 13. 330-336; Referat. Zhur., Biol., 1962, No. 22I29; Biological Abstracts, Vol. 43, No. 3, Abst. No. 8676. 1963.

In obtaining a fixed ration of food, energy output increases as food concentration decreases. The act of providing food is a function of 2 variables: the amount of food obtained by a fish in a certain interval of time and the amount of energy expended during this interval. The author makes an attempt at correlating ecological and physiological methods for the purpose of analyzing the problem of providing fish with food. The proposed method of computation has been worked out for the plankton-eaters (bleak). The relation is $r = R\ (1 - 10^{-\beta p})$ where r is the ration at the food concentration p; R is the largest possible ration for an unlimited amount of food during the interval under consideration, and β is a constant. The expended part of the energy of metabolism consists of energy liberated at relative bodily rest $-Q_s$, and of energy liberated during motion $-Q$. In the course of 24 hours, the fish, moving with a certain speed, spends part of the time, a, feeding, and (24 - a) in a state of rest. Energy expended by bleak fry during 24 hours will be given by $\overline{Q} = a\ (Q - Q_s) + 24\ Q_s$. Calculation shows that during a 24-hr period, at a water temperature of 20° C, a young bleak feeds 9.6 hr, receives with its food 25.58 cal, uses up in growth 5.025 cal, and fails to assimilate 7.7 cal. A formula for calculating the coefficient of food-consumption is also given:

$$\epsilon = \frac{R\ (1 - 10^{-\beta p})}{\pi p^2 VP},$$

where p is the distance between the fish and the object encountered, and V is the swimming speed (for bleak, 107.28 m/hr).

6174. Ivlev, V. S. 1962. A METHOD FOR CALCULATING THE AMOUNT OF FOOD REQUIRED BY A GROWING FISH. (METOD VYCHISLENIYA KOLICHESTVA PISHCHI, POTREBLYAEMOI RASTUSHCHEI RYBOI.) Akad. Nauk SSSR: Moscow-Leningrad. 132-137; Referat. Zhur., Biol., 1962, No. 18I41; Biological Abstracts, Vol. 43, No. 3, Abst. No. 8677. 1963.

The article describes a method for calculations of the quantity of food required by a fish without conducting special experiments. The method is presented on the basis of systematizing extensive material on research into energy exchange in fish.

6175. Kazanskii, B. N. 1962. EXPERIMENTAL AND HISTOPHYSIOLOGICAL ANALYSIS OF CHANGES IN SEXUAL CYCLES OF FISH UNDER THE EFFECTS OF ECOLOGICAL FACTORS. (EKSPERIMENTAL'NYI I GISTOFIZIOLOGICHESKII ANALIZ IZMENENIYA POLOVYKH TSIKLOV RYB POD VOZDEISTVIEM EKOLOGICHESKIKH FAKTOROV.) Vysshaya Shkola: Moscow. 5. 88-89; Referat

Zhur., Biol., 1962, No. 18I58; Biological Abstracts, Vol. 43, No. 3, Abst. No. 8682. 1963.

Two stages are defined on the basis of an experimental analysis of oogenesis: prior to inception of vitellogenesis and after its consummation, when the relationship of oöcyte growth and the sexual cycle to temperature, light and other factors of external environment assumes a staggered pattern. Selecting defined values of temperature and illumination over these two stages, the author obtained prolonged arrests in the sexual cycle of fish spawning in the spring (Acipenser, Gasterosteus aculeatus) and in the fall (Coregonus albula).

6176. Lyashenko, A. F. 1962. SPECIES COMPOSITION AND YIELD OF YOUNG FISH IN THE KAKHOV RESERVOIR. (O VIDOVOM SOSTAVE I UROZHAINOSTI MOLODI RYB KAKHOVSKOGO VODOKHRANILISHCHA.) Vysshaya Shkola: Moscow. 5: 121-123; Referat. Zhur., Biol., 1962, No. 19I68; Biological Abstracts, Vol. 43, No. 3, Abst. No. 8697. 1963.

In the Kakhov Reservoir after 4 years of existence, the young of 41 species of fish (9 families) were observed. Of them, 23 species were small-value and waste fish. There was little change in the species composition of the young fish in comparison with the section of the Lower Dnieper before regulation. The basic factor determining numbers of young was the reproductive conditions, which added up differently for various species. The highest yield of the young was in the first year, but in the second year of the reservoir's existence, the reproductive conditions became worse and the yield of the young, with the exception of Clupeonella delicatula delicatula, was lower. This year's brood of these fish grew better in the reservoir than those of species in the river before the formation of the reservoir.

6177. Marshin, V. G. 1962. DEPENDENCE OF FISH BEHAVIOR ON ECOLOGICAL SPECIALIZATION OF NERVOUS ACTIVITY. (OBUSLOVLENNOST' POVEDENIYA RYB EKOLOFICHESKOI SPETSIALIZATSIEI NERVNOI DEYATEL'NOSTI.) Vysshaya Shkola: Moscow. 5: 128-129; Referat. Zhur., Biol., 1962, No. 23I77; Biological Abstracts, Vol. 43, No. 3, Abst. No. 8701. 1963.

A study was made of the higher nervous activity in spiny sturgeon (Acipenser nudiventris) and Russian sturgeon (A. güldenstädti) and their reciprocal hybrids; growth rate, resistance to unfavorable influences, relation to light and temperature, and motor activity were also studied. The two species exhibited statistically significant differences in strength and stability of nervous behavior. These differences are the result of different relations to environmental factors prevalent in the course of ontogenesis. It was experimentally shown that, up to the 2nd year of life, A. güldenstädti manifests a relatively strong nerve impulse, which is interpretable in terms of its adaptation to low temperatures at which the experiments were conducted. From the age of 2 years conditioned reflexes developed more rapidly in A. nudiventris; this is explained by its greater adaptability to fresh-water in which the fishes were cultivated. As regards intensity of the nerve impulse, the hybrids resembled the maternal form; as regards intensity of the inhibitory process, they occupied an intermediate position. Differences observed in rate of development of conditioned reflexes in closely related fish species proved to be determined by differences in unconditioned reflexes (relation to temperature and salinity).

6178. Movchan, V. A. 1962. ECOLOGY OF FISH CULTIVATION REARING IN FLOODED RICE FIELDS. (EKOLOGIYA VYRASHCHIVANIYA RYBY NA ZALIVNYKH RISOVYKH POLYAKH.) Vysshaya Shkola: Moscow. 5: 138-139; Referat. Zhur., Biol., 1962, No. 23I101; Biological Abstracts, Vol. 43, No. 3, Abst. No. 8712. 1963.

Experimental raising of carp in 1948-1951 in rice fields in the Nikolaev and Zaporogian regions showed that the gas regime in the water in these fields was quite favorable for rearing fish. Rice production increased. Carp were found to feed on larvae of malarial mosquitoes. Addition of mineral fertilizers resulted in an increase of food production.

6179. Parfenik, A. N. 1962. EFFECT OF ENVIRONMENT OF VARIABILITY OF MORPHOLOGICAL CHARACTERS IN TROUT (SALMO TRUTTA M. FARIO L.) OF THE KBASSR (KABARDINO-BALKARIAN REPUBLIC). (VLIYANIE SREDY NA IZMENCHIVOST' MORFOLOGICHESKIKH PRIZNAKOV FORELI KBASSR (SALMO TRUTTA M. FARIO L.).) Uch. Zap. Kabardino-Balkarsk. Univ. 12: 211-219; Referat. Zhur., Biol., 1962, No. 23I1; Biological Abstracts, Vol. 43, No. 3, Abst. No. 8720. 1963.

Comparative analysis of S. trutta from 3 different rivers revealed that length and height of caudal peduncle, relative width of head and body, as well as length of lower lobe of the caudal fin are influenced by environment and are adaptive. Other characteristics (number of vertebrae, number of scales in the lateral line, number of gill-rakers, and number of fin-rays) are correlated with physiological modifications of the organism.

6180. Persov, G. M., and O. F. Sakun. 1962. CONDITION OF SEX GLANDS OF PINK SALMON (ONCORHYNCHUS GORBUSCHA) IN DIFFERENT STAGES OF ITS LIFE CYCLE IN CONNECTION WITH ITS ACCLIMATIZATION IN BASINS OF THE WHITE AND BARENTS SEAS. (SOSTOYANIE POLOVYKH ZHELEZ U GORBUSHI NA RASNYKH ETAPAKH EE ZHIZNENNOGO TSIKLA V SVYAZI S AKKLIMATIZATSIEI V BASSEINAKH BELOGO I BARENTSOVA MOREI.) Uch. Zap. Leningradsk. Gos. Univ. 311: 92-108; Referat. Zhur., Biol., 1962, No. 24I63; Biological Abstracts, Vol. 43, No. 3, Abst. No. 8723. 1963.

6181. Pinskii, F. Ya. 1961. THE DAILY

RHYTHM OF FEEDING BY ATLANTIC SALMON FINGERLINGS (SALMO SALAR). (O SUTOCHNOM RITME PITANIYA SEGOLETOK LOSOSYA (SALMO SALAR L.).) Tr. Nauchn.-Issled. Inst. Rybn. Khoz. Latviisk. SSR 3: 495-503; Referat. Zhur., Biol., 1963, No. 2I21; Biological Abstracts, Vol. 43, No. 3, Abst. No. 8727. 1963.

The feeding of Salmo salar 31-111 mm long (38-61 mm on the average), growing in ponds, was studied from May to September. Two peaks of feeding intensity were noted during the day (between 4 and 8 o'clock in the morning and 4 and 8 o'clock in the evening). During the morning peak Asellus aquaticus and larvae of Trichoptera, Ephemeroptera and Coleoptera played a primary role. In the evening peak, the role of Oligochaeta, Cladocera and Copepoda increased; they appeared to be obligatory foods. Phytophilic and predatory forms of chironomid larvae were of great importance in salmon feeding.

6182. Royce, William F., Donald E. Bevan, James A. Crutchfield, Gerald J. Paulik, and Robert L. Fletcher (Univ. Wash. Coll. Fish., Seattle, Washington). 1963. SALMON GEAR LIMITATION IN NORTHERN WASHINGTON WATERS. AN ECONOMIC, BIOLOGICAL, AND LEGAL SURVEY OF THE SALMON RESOURCE OF NORTHERN PUGET SOUND AND STRAIT OF JUAN DE FUCA. Univ. Wash. Publ. Fish. 2(1): 1-123; Biological Abstracts, Vol. 43, No. 3, Abst. No. 8734. 1963.

The excess fishing gear used to harvest the salmon resource of northern Puget Sound and Strait of Juan de Fuca has endangered the conservation of the salmon runs and greatly reduced the earnings of the men and vessels engaged. The international Pacific Salmon Fisheries Commission has officially requested that the gear be reduced, but it lacks the power to require its reduction. This study is the result of a request by the Governor's Fishery Advisory Committee and the Legislative Interim Committee on Fisheries to the University of Washington. The study has been organized in three main parts: (A) Biostatistical analyses of the catches to determine the amount by which the gear can be reduced and the runs still harvested; (B) Economic studies to determine the recent earnings of men and vessels and to estimate the effect on earnings of a reduction in gear; and (C) Legal studies to determine whether a legislatively-prescribed scheme for restricting the number of units of gear fishing would be valid. The findings are: (1) The number of units of fishing gear can be reduced to two-thirds the recent amount, and all runs can be fully harvested. The number might be reduced to as little as one-half the recent amount with no effect on the full harvest of any except very large runs. (2) The recent earning of all three major types of gear are severely depressed despite record or near-record runs of the most valuable species, the sockeye. (3) If the number of units of fishing gear were reduced to two-thirds the recent number, the additional income to boat owners and fishermen would range from $700,000 to $2,500,000 annually, depending on the size and composition of the run. (4) Any further increase in the numbers of units fishing or decrease in the size of the runs will cause more severe economic loss. (5) Conservation regulations can be more precise with fewer units of fishing gear and the runs will be subject to less risk of overfishing. (6) Broadly speaking, if legislation to limit the number of fishermen is enacted, it would seem likely to withstand challenge based on the constitutional concepts of due process and equal protection, for the following basic requirements would be met: The legislature has proceeded upon some basis in fact; it has made a rational determination that some benefit to the general welfare of the people would be served by the legislation; and further, it has made a rational choice of means to accomplish that benefit. Such legislation should not, nor is it contemplated that it would, discriminate against nonresidents of the State. As to specific provisions of such legialation, the conclusion is drawn that a grandfather clause would be valid, but other details have been examined cursorily or not at all, since the detail of proposed legislation has not been determined. Recommendations are made for specific steps to reduce the number of units of fishing gear. (Authors)

6183. Sedlár, Ján (Univ. Sch. Agric., Nitra, Czechoslovakia). 1962. THE EFFECT OF REGULATION OF A STOCK UPON ITS FURTHER DEVELOPMENT. (VPLYV REGULÁCIE OBSÁDOK NA ICH DALSIE FORMOVANIE.) Pol'nohospodárstvo 9(8): 597-606; Biological Abstracts, Vol. 43, No. 3, Abst. No. 8741. 1963.

The present size of fish stocks in some zones of Nitrica Brook and the possibilities for their improvement are discussed. The initial stocks were unsatisfactory, because although the stream here is a trout and grayling stream (Salmo trutta morpha fario and Thymallus thymallus) these species had been driven back by increased numbers of Leuciscus cephalus, Chondrostoma nasus, and Barbus barbus L. According to results from five randomized localities, trout and grayling made up only 15% by number and 21.6% by weight of the whole stock. Stock improvement was done during a period of 3 years by fishing out undesirable species and planting trout and grayling. The stock of trout and grayling increased over 3 years as follows: in the first section 11.5% in the first year, 18.8% in the second, and 27.8% by number in the third year, or 16.4%, 26.9% and 38.0% by weight. In the second section it was 9.3%, 19.4% and 31.5% by number, and 12.2%, 28.8% and 39.7% by weight. (Auth.)

6184. Tiemeier, Otto W. (Kansas State Univ., Agric. Exptl. Sta., Manhatten). 1962. SURVIVAL OF FISH IN DEEP WATER OF FARM PONDS DURING THE SUMMER. Trans. Kansas Acad. Sci. 65(4): 463-466; Biological Abstracts, Vol. 43, No. 3, Abst. No. 8752. 1963.

Bluegill, Lepomis macrochirus; largemouth bass, Micropterus salmoides; yellow perch, Perca flavescens; black crappie, Pomoxis nigromaculatus; channel catfish, Ictalurus punctatus; black bullhead, I. melas; and carp, Cyprinus carpio, were the fish stocked in the ponds. Results indicate that deeper water of many ponds is not a suitable habitat during much of the summer because of lack of O_2, temperature difference and high CO_2 content.

6185. Turdakov, F. A. 1962. APPLICATION OF STATISTICAL INDICES OF VARIATION TO THE STUDY OF PROBLEMS OF VARIABILITY OF FISH POPULATIONS. (PRIMENENIE VARIATSIONNO-STATISTICHESKIKH POKAZATELEI V ISSLEDOVANII NEKOTORYKH VOPROSOV IZMENCHIVOSTI V POPULYATSIYAKH RYB.) Kievsk. Univ.: Kiev. 4: 152-153; Referat. Zhur., Biol., 1962, No. 23I43; Biological Abstracts, Vol. 43, No. 3, Abst. No. 8757. 1963.

In calculating many indexes of morphological characteristics, it is found that the mean value of the index is related inversely to the coefficient of variation. At a constant inverse relation that is characteristic for a species, separate races and populations of the species can exhibit diversity in the expression of the relation, i. e., they can differ in degree of variability. This accounts for genetic heterogeneity, for differences in conditions of life, etc. In the course of development, variability in size (silkworm and fish) is least in the egg stage, increases to a maximum during stages of intensive growth, and falls markedly at completion of development. The mean coefficient of variation for a whole complex of morphological characteristics reaches a maximum during the period of sexual maturation and then diminishes. Change in the index of variation ($t = M = (M_2M_1)$: $\sqrt{m_1^2 + m_2^2}$, where m is the mean square error) which represents the difference in intensity of variation between two comparable stages of development, parallels the change in the coefficient of variation (which reflects the intensity of variance t) and reaches the greatest value when the fish attains sexual maturity. Population variance during this period is determined in large measure by the same factors which bring about sexual maturation. These phenomena stand in direct relation to the mechanism operative in natural selection.

6186. Vasilenko-Lukina, O. V. (Northeastern Comprehensive Sci.-Res. Inst., Siberian Dept., Acad. Sci. USSR, Magadan, USSR). 1962. ON THE BIOLOGY OF THE PINK SALMON OF THE MARTIME PROVINCE, ONCORHYNCHUS GORBUSCHA (WALBAUM). (O BIOLOGII PRIMORSKOI GORBUSHI ONCORHYNCHUS GORBUSCHA (WALBAUM).) Vopr. Ikhtiol. 2(4): 604-608; Biological Abstracts, Vol. 43, No. 3, Abst. No. 8760. 1963.

The breeding behavior of Oncorhynchus gorbuscha was studied in the Ulika River, a tributary of the Tumnin River, from 1957 through 1959. Results showed only 1 breeding pair per 3-5 m^2 of breeding ground, compared with 4-8 pairs per m^2 for other years. In 1957 and 1959 an average of 800 eggs were found per redd, while in 1958 there were 964 eggs per redd. Egg losses for 1957 and 1959 were as high as 50.7 and 57.1% respectively, while for 1958 there were only 13%. Only 9.2% of the number of 1957 fry leaving the river returned in 1958. The chief natural enemies of the fry are Salvelinus alpinus and S. leucomaenis. (S. P.)

6187. Vernidub, M. F. 1960. THE EFFECT OF DRAINAGE WATER OF THE GAS-SHALE INDUSTRY ON THE PHYSIOLOGICAL PROCESSES AND GROWTH OF LARVAE AND YOUNG SALMON. (VLIYANIE STOCHNYKH VOD GAZO-SLANTSEVOGO PROIZVODSTVA NA FIZIOLOGICHESKIE PROTSESSY I NA RAZVITIE LICHINOK I MOLODI LOSOSYA.) Moscow. 142-156; Referat. Zhur., Biol., 1962, No. 19I78; Biological Abstracts, Vol. 43, No. 3, Abst. No. 8764. 1963.

Non-volatile phenol (NP), contained in the drainage waters of a gas-shale plant, caused a series of pathological changes in salmon larvae. Under the short-term influence of NP, the motile activity in the larvae was increased. The appearance of the first signs of stimulation were accompanied by a reduction or temporary loss of a negative reaction of light and to an increase in the water temperature to 15° C. With a lower concentration of NP, the larvae stimulation increased slowly, and with a higher concentration the larvae began tetanic convulsions within a few hours. A high concentration of NP led also to a distortion of the larvae reaction to temperature gradient and produced changes in the performance of the cardiovascular system. A low concentration of NP reinforced erythropoiesis. Later, however, it was retarded and the erythrocytes of the embryonic type began to decompose. In water containing a high concentration of NP, the process of erythrocyte decomposition took place very quickly.

6188. Zhuravel', P. A. 1961. SOME CONSIDERATIONS IN THE STOCKING OF NEW SPECIES OF FOOD FAUNA IN CRIMEAN RESERVOIRS. (NEKOTORYE SOOBRAZHENIYA PO VSELENIYU NOVYKH VIDOV KORMOVOI FAUNY V VODOKHRANILISHCHA KRYMA.) Tr. Vses. Gidrobiol. Obshch. 11: 338-344; Referat. Zhur., Biol., 1962, No. 20Zh488; Biological Abstracts, Vol. 43, No. 3, Abst. No. 8777. 1963.

The modern fauna of the Crimea, both terrestrial and aquatic, is depleted. Water reservoirs constructed in the Crimea have poor ichthyofauna and low food productivity. Thus, since 1955 work was begun to acclimatize new species of fish and food invertebrates in them. A number of the following species have been stocked: fresh-water oligochetes, gastropods, and bivalve molluscs, Caspian gammarids and mysids; according to existing data, the latter two groups have survived very well. As measured by the presence of some boreal forms, decreased bottom temperature and low mineralization, it may be assumed that it is possible for some

Crimean reservoirs to furnish habitation for representatives of northern relicts, as well as Baikal and Fareastern fauna. Caspian mysids can be acclimatized to the north, in the Baltic basin. In species introduced and adapted to new conditions, various physiological and morphological changes can occur.

6189. Willis, R. P. (New Zealand Oceanographic Inst., Wellington). 1963. A SMALL TOWED NET FOR OCEAN SURFACE SAMPLING. N. Z. Journal of Science, Vol. 6, No. 1, pp. 120-126.

The small ocean surface sampler described consists essentially of a 200 mesh nylon net supported by a pair of plastic floats and measuring just over 2 feet long. When streamed from a ship it samples only the top centimeter of water.

6190. Abrosimova, N. M., and R. I. Tatarskaya (Inst. Radiation and Phys.-Chem. Biol., Acad. Sci., USSR, Moscow). 1963. ADENOSINE TRIPHOSPHATASE AND SOME OTHER ENZYMES OF PHOSPHORUS METABOLISM IN HOMOGENATES AND EXTRACTS OF FISH EGGS. (ADENOZINTRIFOSFATAZA I NEKOTORYE DRUGIE FERMENTY FOSFORNOGO OBMENA V GOMOGENATAKH I AKSTRAKTAKH YAITS RYB.) Biokhimiya 28(1): 128-136; Biological Abstracts, Vol. 43, No. 3, Abst. No. 8938. 1963.

In ripe unfertilized ova of fish the following enzymes have been revealed, besides ATPase: 5'-nucleotidase (only in sturgeons), nonspecific acid phosphatase, inorganic pyrophosphatase, adenylate kinase and adenylate deaminase. For ATPhase assays conditions have been adjusted in such a way that the presence of other phosphatases did not interfere with the results obtained. The ATPase activity does not change significantly within the range of pH 6.5-9.0, while beyond this range it greatly decreases. In the homogenates of sturgeon eggs, ATPase is not activated by divalent cations such as Ca++ and Mg++. In the homogenates of Misgurnus fossilis eggs Mg++ but not Ca++ exerts an activating effect. The activity of the egg ATPase increases upon aging of the homogenates or addition of DNP (the DNP activation effect is removed by sodium azide). These observations as well as the fact that upon extraction of ATPase by trisbuffer, pH 7.5 ca one half of total ATPase activity of the homogenate can be found in the non-extractable residue, warrant the conclusion that ATPase of ova is bound to cellular structures. (Authors)

6191. Musacchia, X. J., and D. D. Westhoff (Biol. Dept., St. Louis Univ., St. Louis, Missouri). 1963. COMPARISONS OF ACTIVE ABSORPTION, IN VITRO, IN FISH INTESTINE. In: 47th Annual meeting of the Federation of American Societies for Experimental Biology, 1963. Fed. Proc. 22(2 Pt. 1): 227; Biological Abstracts, Vol. 43, No. 3, Abst. No. 9332. 1963.

6192. Harris, Gerard G., and Willem A. van Bergeijk (Bell Telephone Lab., Murray Hill, New Jersey). 1962. EVIDENCE THAT THE LATERAL-LINE ORGAN RESPONDS TO NEAR-FIELD DISPLACEMENTS OF SOUND SOURCES IN WATER. Jour. Acoustical Soc. Amer. 34(12): 1831-1841; Biological Abstracts, Vol. 43, No. 3, Abst. No. 9976. 1963.

The lateral-line organ of the killifish (Fundulus heteroclitus) is sensitive to a linear function of water displacements associated with the near-field of sound sources, with the displacement probably being the most important factor rather than velocity or acceleration. The near-field effect is discussed and is shown to be important not only for the lateral-line organs but also for the acoustical and vestibular organs. It is emphasized that the near-field effect introduces considerable complications into the study of the acoustico-lateralis system, and is of conceptual importance for the theory of hearing and the study of schooling in fish. (Authors)

6193. Malyukina, G. A. 1962. METHODS OF STUDYING HEARING IN FISH. (METODY ISSLEDOVANIYA SLUKHA RYB.) Akad. Nauk SSSR: Moscow. 277-282; Referat. Zhur., Biol., 1962, No. 1I63; Biological Abstracts, Vol. 43, No. 3, Abst. No. 9980. 1963.

Structure of auditory organs of fish is described, along with methods of studying them and performing surgical operations on them. A description of research methods, based on observations of reactions of fish to sounds, on conditioned reflexes, and on electrophysiology, is presented.

6194. Malyukina, G. A. 1962. METHODS OF STUDYING THE LATERAL LINE OF FISH. (METODY ISSLEDOVANIYA ORGANA BAKOVOI LINII RYB.) Akad. Nauk. SSSR: Moscow. 302-308; Referat. Zhur., Biol., 1962, No. 1I64; Biological Abstracts, Vol. 43, No. 3, Abst. No. 9981. 1963.

Activity of the lateral line was studied by observing responses of blinded fish to specific stimuli. To ensure greater detail of observation, the method of conditioned reflexes was used. Vibration-producing devices for supplying conditioned stimuli are described. Methods of dissecting out auditory organs and lateral line are presented, including electrophysiological methods for investigating the function of the lateral line.

6195. Protasov, V. R. 1962. STUDY OF VISION IN FISH. (IZUCHENIE ZRENIYA RYB.) Akad. Nauk SSSR: Moscow. 262-276; Referat. Zhur., Biol., 1962, No. 1I62; Biological Abstracts, Vol. 43, No. 3, Abst. No. 9982. 1963.

This paper concerns itself with present-day methods for studying vision in relation to spectral sensitivity, motion perception, visual acuity, color differentiation, etc. The methods are based on optometric responses and on discharge of bioelectricity. Devices and methods of investigation are described in detail.

6196. Semenov, K. I. (Inst. Hydrol., Acad. Sci.,

Ukrain. SSR, Kiev, USSR). 1963. BIOLOGICAL VARIABILITY IN THE QUALITY OF EGGS OF THE STURGEON (ACIPENSER GULDENSTADTI BRANDT) AND ITS EFFECT ON THE LARVAL DEVELOPMENT UNDER ARTIFICIAL CONDITIONS. (BIOLOGICHESKAYA RAZNOKACHESTVENNOST' IKRY OSETRA I EE VLIYANIE NA RAZVITIE LICHINOK V USLOVIYAKH ISKUSSTVENNOGO RAZVEDENIYA.) Vopr. Ikhtiol. 3(1): 99-112; Biological Abstracts, Vol. 43, No. 3, Abst. No. 10719. 1963.

Female Dneiper River sturgeons were artificially induced to ovulation by hypophyseal injections. Treated females were opened after given periods and the stages of egg maturation for different ovarian areas were noted. Eggs were incubated and the larvae raised in aquariums. Eggs ovulated first, or those from the posterior part of the ovary, tended to be overmature, while eggs ovulated last, or those from the anterior part of the ovary, tended to be undermature. In general, only those eggs found in the posterior part of the abdominal cavity, or those produced during the 2nd part of ovulation, consistently produced healthy larvae. Eggs ovulated first and lastly varied considerably in their quality and had much higher mortality rates--14.6 and 15.5% greater, respectively, than for eggs ovulated secondly. For each female, larvae developing from larger eggs were larger and more viable (10.6% greater) than those coming from smaller eggs, agreeing with findings for other bony fishes. However, following the conversion to active feeding, sizal differences between the larger and smaller larvae diminish. Actual differences in viabilities between eggs produced by so-called functionally different parts of the same ovary, aside from differences in maturation time mentioned above, were not apparent. In order to insure the highest quality eggs, uniformly ripe masses of eggs should be differentially extracted. (L. T. P.)

6197. Suzuki, Ryo (Dept. Biol., Aichi Gakugei Univ., Okazaki, Japan). 1962. ON THE BEHAVIOR OF CARP-GOLDFISH HYBRIDS. Japanese Jour. Ichthyol. 10(1): 13-15; Biological Abstracts, Vol. 43, No. 6, Abst. No. 21661. 1963.

Intergeneric hybrids are artificially produced from the carp, Cyprinus carpio, female, and the goldfish, Carassius carassius auratus, male, and the reciprocal. Their jumping and feeding behavior, observed one or four months after hatching, is intermediate between that of the two parents. (Auth.)

6198. Kleerekoper, Herman. 1961. THE ROLE OF CHEMICAL SENSE IN THE ORIENTATION OF PETROMYZON MARINUS. Amer. Zool. 1(4): 456; Biological Abstracts, Vol. 43, No. 6, Abst. No. 21837. 1963.

6199. Denton, E. J., and J. A. C. Nicol (The Lab., Citadel Hill, Plymouth, England). 1963. WHY FISHES HAVE SILVERY SIDES; AND A METHOD OF MEASURING REFLECTIVITY. Jour. Physiol. (London) 165(1): 13P-15P; Biological Abstracts, Vol. 43, No. 6, Abst. No. 21916. 1963.

6200. Gordon, William G. (U. S. Bur. Comm. Fish., Ann Arbor, Michigan). 1963. A TRAWLING SURVEY OF SOUTHERN LAKE MICHIGAN (AUGUST-NOVEMBER 1960). Commercial Fish. Rev. 25(2): 1-6; Biological Abstracts, Vol. 43, No. 6, Abst. No. 21941. 1963.

Otter-trawl explorations in southern Lake Michigan were made in the latter half of 1960 by the U. S. Bureau of Commercial Fisheries. The fishing was carried out with vessels chartered from the Lake Michigan trawl fleet. Objectives of the investigation were to determine commercial availability of fish to bottom trawls, seasonal distribution of the fish stocks, and the location and extent of areas suitable for fishing with conventional otter trawls. A total of 134 otter-trawl drags were made at depths ranging from 5 to 45 fathoms around the southern perimeter of the lake from Ludington, Michigan, on the east shore to Sturgeon Bay, Wisconsin, on the west shore. Gear damage was light throughout the area. Weather and sea conditions were generally favorable. Mixed catches of chubs (Leucichthys) alewife, and smelt ranged as high as 1200 pounds per 30-minute drag. These fish were found most consistently at depths of 15 to 30 fathoms and dominated all catches. Yellow perch and whitefish were taken in limited amounts in drags at depths at less than 35 fathoms. Other fish of commercial importance were not taken in significant amounts. (Auth.)

6201. Veselov, E. A. 1962. METHODS OF STUDYING OSMOREGULATION IN FISH. (METODY IZUCHENIYA OSMOREGULYATSII U RYB.) Akad. Nauk SSSR: Moscow. 178-203; Referat. Zhur., Biol., 1963, No. 5I55; Biological Abstracts, Vol. 43, No. 6, Abst. No. 22417. 1963.

Methods of studying osmoregulation in fish through blood analysis are discussed. It is recommended that for analytical purposes blood be kept at low temperature (but not lower than 0° C). It is further recommended that a sinantrin solution (1:1000) be used to prevent coagulation of the blood. Apparatus and technics for obtaining blood from the heart and caudal artery of fish are described, including cryoscopic methods of determining blood osmotic pressure: (1) Beakman's method; (2) microscopic determinations, developed by the author, which permit numerous simultaneous determinations; (3) thermoelectric methods. The tensimetric method of Bardger-Rasta is discussed in relation to its modification by Yastrebov and the author. Folgar's method is recommended for use in determining urine chlorides. Osmotic erythrocyte resistance is characterized by that minimum sodium chloride concentration which fails to induce hemolysis, and is determined by the introduction of erythrocytes into sodium chloride solutions of various concentrations (0.30-0.74%). Bibliography with 19 references.

6202. Engström, Kjell (Zool. Inst., Univ. of Stockholm, Stockholm, Sweden). 1963. CONE TYPES AND CONE ARRANGEMENTS IN TELEOST

RETINAE. Acta Zool. 44(1/2): 179-243; Biological Abstracts, Vol. 43, No. 6, Abst. No. 25547. 1963.

A survey of literature reports, compared with the results from the author's studies of the cones of 79 species. Some aspects on the classification of the cone types and the cone mosaics are discussed. Two main types of single cones are distinguished, differing in size, shape and position in the cone mosaic. The double cones are subdivided into equal and unequal ones, and a wide variation is shown as to their shape. In the cyprinids only, the 2 components of the double cones are shown to separate during dark adaptation. The triple and quadruple cones are both found to be represented by 2 main types. The cone types and the cone mosaics are discussed in relation to the phylogeny and the ecology of the fishes. The main type of mosaic which can be developed in a fish is considered correlated with the phylogeny of the taxonomic unit to which it belongs; the degree of accomplishment of this type of mosaic in a certain species is found to be dependent on its ecology. A regular mosaic is found in the retina of fishes which rely to a great extent on vision, but more irregular or disintegrated mosaics are found in fishes making more use of other senses than of vision. A corresponding variation is found between different regions of the retina. (Auth.)

6203. Hunter, John R. (U. S. Bur. Comm. Fish., San Diego, California). 1963. THE REPRODUCTIVE BEHAVIOR OF THE GREEN SUNFISH, LEPOMIS CYANELLUS. Zoologica (New York) 48(2): 13-24; Biological Abstracts, Vol. 43, No. 6, Abst. No. 25549. 1963.

Male green sunfish aggregated near the nests of the 1st males to construct nests and spawn. Some of these males later constructed nests near the original, thus forming colonies. The nesting periods of sunfish breeding in colonies were synchronized and occurred at an interval of approximately 8 to 9 days. If males failed to nest in colonies, no synchronization of nesting periods was evident. Males tended to construct a series of nests in the same region; more than half of the nests constructed by 25 males were located within a meter of their previous nest. Nest recognition appeared to be partially dependent upon the presence of small landmarks near the nest site. The length of time that nests were occupied varied from 1 to 15 days. Histograms plotted from these data did not form a normal distribution but tended to be bimodal. The possible significance of these data is discussed.

6204. Dill, William A. (Biology Branch, Fish. Div., Food and Agric. Organization of the United Nations, Rome, Italy). 1963. A PARTIAL BIBLIOGRAPHY ON THE ECONOMIC EVALUATION OF SPORT FISHING AND FISHERIES RESOURCES. FAO Fisheries Circular No. 8, 8 pp.

A list of publications concerned with the economic evaluations of sport fisheries is presented.

6205. Simon, Raymond C., and Alexander M. Dollar (Coll. Fish., Univ. Washington, Seattle). 1963. CYTOLOGICAL ASPECTS OF SPECIATION IN TWO NORTH AMERICAN TELEOSTS, SALMO GAIRDNERI AND SALMO CLARKI LEWISI. Canadian Jour. Genet. and Cytol. 5(1): 43-49; Biological Abstracts, Vol. 43, No. 5, Abst. No. 17222. 1963.

The objective of this study has been to attempt to resolve speciation difficulties in two species of trout on the basis of chromosome numbers and morphology. Chromosome numbers and morphology were determined, using squash preparations of blastula chromosomes. This is the first report of the chromosome number in cutthroat (2n = 64) and chromosome morphology in both species. A hypothesis is advanced concerning speciation at the chromosome level, supporting the conclusion that rainbow trout are derived from cutthroat trout. (R. C. S.)

6206. Prazdnikova, N. V. 1962. METHODS OF STUDYING CONDITIONED REFLEXES IN FISH. (METODIKI IZUCHENIYA USLOVNYKH REFLEKSOV U RYB.) Akad. Nauk SSSR: Moscow. 242-261; Referat. Zhur., Biol., 1962, No. 1I61; Biological Abstracts, Vol. 43, No. 5, Abst. No. 17536. 1963.

This paper describes methods of studying food motor conditioned reflexes (food incentive method) and defensive motor conditioned reflexes in fish. It is held that a study of these phenomena permits elucidation of the function of the nervous system as well as of analyzers.

6207. Evropeitseva, N. V. 1962. A COMPARATIVE ANALYSIS OF THE DESMOLTIFICATION PROCESS IN THE YOUNG OF VARIOUS ECOLOGICAL FORMS OF ATLANTIC SALMO SALAR. (SRAVNITEL'NYE ANALIZ PROTSESSA DESMOLTIFIKATSII U MOLODI RAZNYKH EKOLOGICHESKIKH FORM ATLANTICHESKOGO LOSOSYA.) Uch. Zap. Leningradsk. Gos. Univ. 311. 46-73; Referat. Zhur., Biol., 1963, No. 2I65; Biological Abstracts, Vol. 43, No. 5, Abst. No. 17586. 1963.

Salmon smolts kept in ponds underwent changes in color, external and physiological characteristics (growth rate, respiratory rate, respiratory rhythm and others), and became similar again to parr. This desmoltification process was studied in smolts of Baltic anodromous salmon, and in Lake Ladoga to fresh-water salmon. After desmoltification the young fish were in an unstable state and were more sensitive to unfavorable conditions. Release of large smolts in the spring only was recommended, in the early smolt stages or before it begins.

6208. Galkin, G. G. 1961. SURVIVAL AND GROWTH OF ARTIFICIALLY RAISED YOUNG OF BALTIC SALMON (SALMO SALAR) IN THE RIVER PERIOD OF THEIR LIFE. (VYZHIVAEMOST' I ROST ISKUSSTVENNO VYRASHCHENNOI MOLODI BALTIISKOGO LOSOSYA V RECHNOI PERIOD EE ZHIZNI.) Izvest. Gos. Nauchn.-Issled. Inst.

Ozernogo i Rechnogo Rybn. Khoz. 51: 15-27, 266; Referat. Zhur., Biol., 1963, No. 2I27; Biological Abstracts, Vol. 43, No. 5, Abst. No. 17587. 1963.

When fry, small fingerlings and large fingerlings (in the first year of life) of Baltic Salmo salar were released into the Peterup River, which flows into the Gulf of Riga, survival to the stage of downstream migration was 0.2, 5 and 12% respectively. Data on the sex composition, morphological characteristics and "condition" of the immature fish in the downstream migration period are presented.

6209. Kazanskii, B. N. 1962. EXPERIMENTAL ANALYSIS OF THE SEASONAL NATURE OF REPRODUCTION IN VOLGA ACIPENSERIDS AS RELATED TO THE PHENOMENON OF INTRASPECIFIC BIOLOGICAL DIFFERENTIATION. (EKSPERIMENTAL'NYI ANALIZ SEZONNOSTI RAZMNOZHENIYA OSETROVYKH VOLGI V SVYAZI S YAVLENIEM VNUTRIVIDOVOI BIOLOGICHESKOI DIFFERENTSIATSII.) Uch. Zap. Leningradsk. Gos. Univ. 311. 19-45; Referat. Zhur., Biol., 1963, No. 2I44; Biological Abstracts, Vol. 43, No. 5, Abst. No. 17591. 1963.

Gradual injection of hypophysis (a small dose at first and then the usual doses) resulted, after fertilization, in normally growing spawn in the 'hiemal' forms of sturgeons of the lower Volga with an egg yield 6-7 months earlier than with a single injection or with the usual time of natural spawning. It was assumed that the repeated injection of small doses of hypophysis stimulated the fall-winter phase of sonadotrophin secretion to the extent that polarization of the oocytes was accomplished. Injection of a large dose corresponded to a vigorous secretion of hormone in the prespawning and spawning periods. The vernal form of the sturgeons was distinguished from the hiemal by the functional condition of the hypophysis and by the degree of gonad maturity at the time the fish enter the river. Experiments were carried out on the long (2 months) delay in gonad development at the completion of the 4th stage, under the effect of low temperatures. After acclimation of these fish to water at spawning temperature, viable progeny were obtained. It is assumed that the possibility exists of an analogous delay of gonad development in fish under natural conditions, and that this is an evolutionary developmental adaptation. These experiments serve as a basis for discussion of the mechanism of intra-species biological differentiation in Acipenser. Remoteness of spawning grounds from the estuary of the river, and the varying degrees of maturity of the sexual products at the time of entry of the fish into the river, appeared to be the basic differentiating factors.

6210. Koroleva, N. V. 1960. TOLERANCE OF YOUNG SALMON (SALMO SALAR) TO VARIOUS DEGREES OF WATER SALINITY. (USTOICHIVOST' MOLODI SEMGI K RAZLICHNOI SOLENOSTI VODY.) Nauchn.-Tekh. Byul. Gos. Nauchn.-Issled. Inst. Ozernogo i Rechnogo Rybn. Khoz. 12. 33-34; Referat. Zhur., Biol., 1963, No. 2I84; Biological Abstracts, Vol. 43, No. 5, Abst. No. 17592. 1963.

Salmon fingerlings and year-olds of various sizes were placed in 10, 15, 20, and 25% salt solutions and kept for 15 days. With the increase in size of the young fish, the tolerance of salinity increased. Fingerlings weighing about 1 g survived in 10%, but could not stand 15%. Yearlings weighing 6-10 g survived 15% salinity.

6211. Mel'nikov, G. B., and A. M. Chaplina. 1962. MULTIPLE SPECIES CROPS AS A METHOD FOR INCREASING THE PRODUCTIVITY OF PONDS AND SMALL RESERVOIRS IN THE STEPPE ZONE OF THE UKRAINIAN SSR. (POLIKUL'TURA KAK METOD POVYSHENIYA PRODUKTIVNOSTI PRUDOV I MALYKH VODOKHRANILISHCH STEPNOI ZONY USSR.) Tr. Soveshch. Ikhtiol. Komis Akad. Nauk SSSR 14. 74-76; Referat. Zhur., Biol., 1963, No. 3D275; Biological Abstracts, Vol. 43, No. 5, Abst. No. 17595. 1963.

The authors carried out experiments on polyculture of various fish species in 2 ponds (30 and 75 hectares) and a reservoir (200 hectares). The development of inferior fish and those usually found in weedy biotopes was characteristic: gudgeons (Gobio gobio), Leucaspius delineatus, and others. Carp, crucian carp, bream, bluebream (Abramus ballerus), and Pelecus cultratus were stocked. In a 75-hectare pond, where zander and bream were stocked, the growth of carp improved. The pond productivity increased from 1-2 to 5 centners/hectare in 1955. The experiment showed a 5-10 fold increase in pond productivity in ponds and small reservoirs in which polyculture was used. In the Dnepropetrovsk oblast polyculture was introduced into 35% of the ponds on collective farms. In a number of collective farms fish production reached 7-12 centners/hectare. The authors recommend caution when stocking with Carassius auratus, fecund fish, and those displacing other species.

6212. Swain, A. (Ministry Agric., Fish. and Food, London, England). 1963. LONG-DISTANCE MIGRATION OF SALMON. Nature 197(4870): 923; Biological Abstracts, Vol. 43, No. 5, Abst. No. 17605. 1963.

Salmon tagged in England were caught on the west coast of Greenland.

6213. Braunitzer, G., and K. Hilse (Max-Planck. Inst. Biochem., Munich, W. Germany). 1963. THE PHYLOGENY OF THE HEMOGLOBIN MOLECULE. THE CONSTITUTION OF CARP HEMOGLOBIN. (ZUR PHYLOGENIE DES HAMOGLOBINMOLEKULS. DIE KONSTITUTION DES KARPFENHAMOGLOBINS.) Zeit. Physiol. Chem. 330(4/6): 234-236; Biological Abstracts, Vol. 43, No. 5, Abst. No. 17626. 1963.

In carp haemoglobin, the sequence gap in the α-chain is closed between residues 46 and 47. (Auth.)

6214. Black, Edgar C., Anne C. Robertson, and Robert R. Parker. 1961. SOME ASPECTS OF CARBOHYDRATE METABOLISM IN FISH. Univ. of Washington Press: Seattle 5. 89-124; Biological Abstracts, Vol. 43, No. 5, Abst. No. 17971. 1963.

Principle constituents dealt with are glycogen, lactate, pyruvate, and glucose. Three conditions are emphasized, namely, resting, moderate activity, and severe activity. Glycogen levels in both muscle and liver in fish appear to be substantially lower than those recorded for mammals. Glycogen stores in muscle are depleted by one half within 2 minutes of severe exercise in Kamloops trout. The pre-exercise level is not completely regained in 24 hours of rest. During this time, liver glycogen diminishes. Muscle lactate in Kamloops trout increases more than threefold during the first 2 minutes of severe exercise and 4 1/2 times during the first 9 minutes. Muscle lactate does not return to pre-exercise levels until the 6th to the 8th hour of recovery from 15 minutes of strenuous exercise. Blood lactate follows the same course as muscle lactate, but the rate of change is slower. While muscle lactate begins to decline immediately upon cessation of activity, blood lactate continues to rise for a period of 2 to 3 hours and does not approach pre-exercise levels for 8 to 12 hours. Pyruvate levels in muscle and blood of Kamloops trout follow the same course as lactate. The high ratio of lactate to pyruvate may indicate the existence of an hypoxic condition during muscular activity in these fish. Blood-glucose levels do not change significantly during strenuous exercise in fishes. In Kamloops trout and lake trout, blood-glucose levels rise during the latter part of the 24-hour recovery period from 15 minutes of strenuous exercise. Blood-glucose level appears to be maintained during the migration of mature Atlantic salmon. Three changes in behavior of fish are observed during muscular fatigue, namely, a sharp drop in swimming rate, a breakup in normal schooling behavior, and a change from active to passive evasion. Changes in behavior are correlated with changes in carbohydrate metabolism, and with alterations in blood pH and carbonate levels. There are also indications that circulation is markedly reduced following exercise in certain species of fish. Under certain conditions, both in fresh water and in salt water, significant mortality follows severe muscular exercise. In three species of salmon, mortality was correlated with increased blood lactate; however, other possible causes of death are recognized. In general, the pattern of carbohydrate metabolism appears to be in keeping with that worked out for mammals. Where differences occur, they appear to be quantitative, and may be related to the lower body temperatures of fish. (Authors)

6215. Bilinski, E. (Fish. Res. Bd. of Canada, Technol. Sta., Vancouver, Brit. Columbia, Canada). 1963. UTILIZATION OF LIPIDS BY FISH. I. FATTY ACID OXIDATION BY TISSUE SLICES FROM DARK AND WHITE MUSCLE OF RAINBOW TROUT (SALMO GAIRDNERII). Canadian Jour. Biochem. and Physiol. 41(1): 107-112; Biological Abstracts, Vol. 43, No. 5, Abst. No. 18011. 1963.

The ability of the muscular tissue of fish to oxidize fatty acids was studied on rainbow trout (Salmo gairdnerii). The rate of oxidation of Na hexanoate-1-C^{14}, K octanoate-1-C^{14}, and K myristate-1-C^{14} by tissue slices from the lateral dark muscle and from the dorsal white muscle was determined at 25° C by measuring the formation of $C^{14}O_2$. This transformation can be demonstrated in both the white and dark muscle; however, quantitatively a very pronounced difference exists between the 2 tissues, the dark muscle being more active. (Auth.)

6216. Altukhov, Yu. P. 1961. A CONTRIBUTION TO THE KNOWLEDGE OF THE OPTOMOTOR REFLEX IN FISH. (K POZNANIYU OPTOMOTORNOGO REFLEKSA U RYB.) Tr. Karadagsk. Biol. Sta. Akad. Nauk Ukrain. SSR 17. 113-124; Referat. Zhur., Biol., 1963, No. 2I93; Biological Abstracts, Vol. 43, No. 5, Abst. No. 18797. 1963.

The results of experiments with various sized groups of immature grey mullet, Mullus barbatus ponticus and Engraulis encrasicholus are given. The grey mullet fingerlings, 15-20 cm long, displayed a clear optomotor reaction (OR), and in the immature, 50-60 cm long, OR did not appear. In pelagic immature M. barbatus ponticus 3.8-5 cm long, a clear OR was found, and at a length of 5-6 cm, a nystagmus of the eyes was pronounced and OR was absent.

6217. Malyukina, G. A. 1962. SURGERY OF THE FISH BRAIN. (OPERATSII NA GOLOVNOM MOZGE RYB.) Akad. Nauk SSSR: Moscow. 319-323; Referat. Zhur., Biol., 1962, No. 1I65; Biological Abstracts, Vol. 43, No. 5, Abst. No. 18900. 1963.

Urethane, ether, or gaseous narcotics are used in operations on fish's central nervous system. Methods employed in surgery of the fore-brain, visual layers, and cerebellum of fish are described.

6218. Anonymous. 1963. STREAM CATALOG OF SOUTHEASTERN ALASKA, REGULATORY DISTRICTS NOS. 3 AND 4. U. S. Fish and Wildlife Service, Special Scientific Report--Fisheries No. 465, 324 pp.

Information about part of southeastern Alaska salmon streams is cataloged from the voluminous records of the Alaska Department of Fish and Game, the Alaska Salmon Industry, the Fisheries Research Institute of the University of Washington, the U. S. Fish and Wildlife Service, and other agencies. Stream descriptions, maps, and historical records of salmon escapement data are compiled for 80 salmon streams in Regulatory Districts Nos. 3 and 4. Each stream is located geographically by latitude and longitude, and by orientation to prominent landmasses. A standard numbering system, number designations formerly in use, and common names of each stream are listed. Physical descriptions

are presented for the intertidal zone and the upstream area of each stream. Available records of weather, water temperatures, and information useful to ground and aerial stream surveyors are presented in brief form. The species of salmon utilizing the spawning grounds and estimates of the escapements each year for many years are given.

6219. Gerdes, John H., and Wm. J. McConnell (Arizona Cooperative Wildl. Research Unit, The Univ. of Arizona, Tucson). 1963. FOOD HABITS AND SPAWNING OF THE THREADFIN SHAD IN A SMALL DESERT IMPOUNDMENT. Jour. of the Arizona Academy of Science, Vol. 2, pp. 113-116.

An effort is made to evaluate the role of the threadfin shad in a small impoundment created with fishing as its only function. The most striking observation was the great preponderance of amorphous organic matter ingested by the threadfin shad in Pena Blanca Lake. The study also indicates that animals are considerably more important in the diet than fresh plant material. The fact that copepods and cladocerans can be important forage in some situations may indicate potential competition with young of game species. In 1959 the spawning peak of the threadfin shad fell between May 26 and June 24. Actual spawning was observed on at least three dates and is described.

6220. Percival, E. (The Late), and A. M. R. Burnet (Fish. Lab., Marine Dept., Christchurch, New Zealand). 1963. A STUDY OF THE LAKE LYNDON RAINBOW TROUT (SALMO GAIRDNERI). N. Z. Jour. of Sci., Vol. 6, No. 2, pp. 273-303.

The records of anglers' catches and scale collections show a period of rapid growth up to about the year 1940, and since then a period of slower growth. From 1948 to 1961 the fish population has been studied by netting samples of fish, tagging them, and collecting angling records. During the study three dominant year classes have occurred, and the consequent population cycles are described. It is concluded that an increase in angler exploitation has increased the density dependent survival rates of the juveniles. The greater number of juveniles has reduced the growth rate, and thus the maximum size of the fish. The following factors are considered as causes of the population cycles--a predator-prey relationship within the trout population (cannibalism), the effect of a rapid increase in angler exploitation, and variations in the angler exploitation rate. The transfer of tagged Lake Lyndon trout to lakes in Georgina, Coleridge, and Pearson has shown that the fish still have the potential for rapid growth. It is concluded that population numbers, and environment are the main factors controlling growth and size. (Authors)

6221. Anonymous. 1962. THE EXPLOITATION, SCIENTIFIC INVESTIGATION AND MANAGEMENT OF SALMON (GENUS ONCORHYNCHUS) STOCKS ON THE PACIFIC COAST OF THE UNITED STATES IN RELATION TO THE ABSTENTION PROVISIONS OF THE NORTH PACIFIC FISHERIES CONVENTION. International North Pacific Fish. Comm., Bulletin No. 10, 160 pp.

This bulletin contains a series of seventeen papers on Pacific salmon which provide the International North Pacific Fisheries Commission with information to determine whether such fish stocks continue to qualify for abstention from fishing in accordance with the International Convention for the High Seas Fisheries of the North Pacific Ocean. Topics discussed include the statistics on salmon as to each species separately for each area, salmon stocks by species in the area north of Bristol Bay, escapement-return relationships, the salmon fisheries in areas adjacent to the Aleutian Islands, the basis on which a standard unit of effort was developed, intensity of salmon fishing and rate of exploitation, relationships between numbers of salmon spawners and resultant seaward migrants, and age composition by species of salmon by area since 1934.

6222. Alverson, Dayton L., and Maurice E. Stansby (U. S. Bureau of Comm. Fish., Seattle, Washington). 1963. THE SPINY DOGFISH (SQUALUS ACANTHIAS) IN THE NORTHEASTERN PACIFIC. U. S. Fish and Wildlife Service, Special Scientific Report--Fisheries No. 447, 25 pp.

Recent depredations attributed to dogfish have been of serious concern to commercial and sport fishermen in the Pacific Northwest. Three possible ways of controlling the dogfish, all of them dependent upon a knowledge of dogfish biology, are discussed. Of these, development of a commercial dogfish fishery appears to be the most practical. Development of such a fishery, however, is dependent upon research leading to a high market demand for dogfish products. To assure the success of the fishery, all parts of the dogfish should have uses. Moreover, at least some of the products derived from dogfish should serve unique uses and be obtainable from no other source. Finally, a careful examination of import relationships must be made to assure that a domestic dogfish fishery would be able to compete with foreign fisheries. (Authors)

6223. Heath, Wallace G. (Dept. of Biology, Western Washington State Coll., Bellingham). 1963. THERMOPERIODISM IN SEA-RUN CUTTHROAT TROUT (SALMO CLARKI CLARKI). Science, Vol. 142, No. 3591, pp. 486-488.

Thermal tolerances from square-wave cycled temperature acclimation were compared with those from constant acclimation temperatures. A response to the maximum temperature of the square-wave cycle occurred. The acclimation thermoperiod was varied from one-fourth to twice the 24-hour cycle, and a relative maximum of tolerance resulted for the 24-hour thermoperiod. This suggests physiological adaption to natural 24-hour thermoperiods. (Auth.)

6224. Brown, C. J. D. (Montana State College,

Bozeman). 1962. A PRELIMINARY LIST OF MONTANA FISHES. Proceedings of the Montana Academy of Sciences 22: 21-26.

The list, based on approximately 800 collections, comprises 17 families and 75 species. Fifty species are considered native while 25 species representing six families are probably foreign to the original fish fauna of Montana.

6225. Wetzel, Robert G. (Dept. of Fish., Univ. of Michigan, Ann Arbor). 1960. MARL ENCRUSTATION ON HYDROPHYTES IN SEVERAL MICHIGAN LAKES. Oikos, Vol. 11, No. 2, pp. 223-236.

Representative hydrophyte samples were taken from comparative transects in four bodies of waters in southeastern Michigan. A simple laboratory technique was employed to determine quantitatively the amount of monocarbonate marl deposit present per gram of plant material (dry weight).

Among the areas investigated, differences in marl encrustation were slight for like species under similar environmental conditions. Considerable variation in deposition was found among different species. Among emergent and floating hydrophytes, capable of direct utilization of atmospheric carbon dioxide, encrustation on submerged portions was highly variable and proportional to the extent of development of attached periphyton. Among submerged species deposits are considerably greater and variations are correlated with several factors, namely, morphological variations and differential bicarbonate utilization.

Intraspecific variations were found also, with encrustation increasing with increasing depth on the individual hydrophyte. Although mechanical removal of the brittle deposits induced by surface wave action is the primary factor decreasing surface encrustation, other factors may be involved.

Agencies of marl formation are discussed, including induced precipitation by bacteria, phytoplankton, periphyton, and macrophytes, as well as direct physical precipitation. (Auth.)

6226. Nomura, Minoru, and Zenjiro Uematsu (Tokyo Univ. Fish., Minato-ku, Tokyo, Japan). 1962. STUDIES ON REPRODUCTION OF RAINBOW TROUT, SALMO GAIRDNERI, WITH SPECIAL REFERENCE TO EGG TAKING. II. ADVANCING OF SPAWNING PERIOD BY INTRODUCTION OF NEW STRAIN AND SELECTIVE BREEDING. Bull. of the Japanese Society of Scientific Fisheries, Vol. 28, No. 11, pp. 1064-1069.

The present report consists of two parts: (1) the introduction of eggs fertilized earlier in a different hatchery, and (2) selective breeding to accelerate maturation.

(1) On December 25, 1951, 34,670 eyed rainbow trout eggs were brought to the Oizumi Trout Hatchery, Tokyo University of Fisheries, from the Samegai Trout Hatchery, Shiga Prefecture. The Samegai strain spawns earlier than the Oizumi strain. The first spawning of the Samegai strain in the Oizumi Hatchery occurred in December 1953. This study was then continued through the 1956 spawning season. The Samegai strain spawned 15 to 30 days earlier than the Oizumi strain; however, the spawning period of the Samegai strain tended to retard slightly with an advance in age of the fish.

(2) Selective breeding for advancing the period of maturation was carried out on two types of early spawners. The opening day of egg taking operations was advanced from the end of December to mid November. The peak of spawning also advanced to late December from mid January. The authors conclude that endocrinological treatment or light and/or temperature control are better than selective breeding as less time is required to achieve results.

6227. Nomura, Minoru (Tokyo Univ. Fish., Minato-ku, Tokyo, Japan). 1962. STUDIES ON REPRODUCTION OF RAINBOW TROUT, SALMO GAIRDNERI, WITH SPECIAL REFERENCE TO EGG TAKING. III. ACCELERATION OF SPAWNING BY CONTROL OF LIGHT. Bull. of the Japanese Society of Scientific Fisheries, Vol. 28, No. 11, pp. 1070-1076.

An experiment was made to induce the earlier spawning of rainbow trout by the control of photoperiodicity.

Experiment No. 1 was conducted in a circular pond (diameter 5.3 m) supplied with a constant flow of spring water at the rate of about 200 liters per minute and the temperature was kept constant at nearly 10.6° C. The light was controlled by 4 overhead 100 watt lamps and a dark curtain covering over the pond. Thirty females and 20 males were used. The experiment began on March 18, 1957. Egg taking operations started on October 12, 1957, and 30,164 eggs were collected from 13 females (43% of fish used) by December 12. Only 5.6 percent of the control fish spawned by that time.

Experiment No. 2 made use of the same pond and equipment as Experiment No. 1. Forty females and 20 males of 2- and 3-year-old rainbow trout were stripped on January 21, 1958, and transferred to the experimental circular pond on the same date. They were reduced in number to 28 females and 15 males by the start of the experiment on February 23, 1958. The first eggs were taken from a female on August 20, 1958, and by December 15, 21 females (75% of fish used) produced 41,048 eggs. Therefore, it was confirmed that these fish spawned two times (January and August to December) in 1958. Since the egg taking from 75 percent of the control fish lasted to January 18, 1959, it was apparent that the experimental fish spawned a month earlier than the control fish.

In Experiment No. 3, both rainbow trout (29 females, 15 males) and brook trout (12 females, 9 males) were used. In this experiment 200 watt, instead of 100 watt, lamps were used. The fish received 6 hours of artificial light (9 a.m. -3 p.m.) per day through the experiment from July 10 to December 29, 1961.

In brook trout the first eggs were taken from a female fertilized by 4 males on October 2, 1961, and by November 11 nearly 36,000 eggs were collected from all 12 females. Only 38.9 percent of the control fish spawned by that time.

Rainbow trout egg taking operations began on October 31, and about 55,000 eggs were collected from 26 females (89.6% of fish used) by December 29. Only 59.9 percent of the control fish spawned by that time. Between the two species tested, brook trout appear to be more readily adjusted to light control than rainbow.

The egg size of the experimental fish was slightly smaller than that of the control, but the number of eggs taken per female was reversed.

6228. Yamazaki, Fumio (Faculty of Fisheries, Hokkaido Univ., Hakodate, Japan). 1962. EFFECTS OF HYPOPHYSECTOMY ON THE OVULATION, OVIPOSITION AND SEXUAL BEHAVIOR IN THE GOLDFISH, CARASSIUS AURATUS. Bulletin of the Faculty of Fisheries, Hokkaido Univ., Vol. 13, No. 2, pp. 39-46.

Hypophysectomy inhibited ovulation, but not oviposition in goldfish.

Hypophysectomized males showed normal sexual behavior, but ceased sperm emission within a short time after hypophysectomy. (Auth.)

6229. Inaba, Densaburo, Chinkichi Ogino, Chiaki Takamatsu, Tadashi Ueda, and Ken-ichi Kurokawa (Tokyo Univ. Fish., Shiba Kaigandori 6, Minato-ku, Tokyo, Japan). 1963. DIGESTIBILITY OF DIETARY PROTEIN AND STARCH IN RAINBOW TROUT. Bulletin of the Japanese Society of Scientific Fisheries, Vol. 29, No. 3, pp. 242-244.

The digestibilities of protein and starch in the diets containing different levels of these nutrients were determined by the indirect method using Cr_2O_3 as an indicator. The fish used were rainbow trout. The digestibilities of protein and α-starch (cooked) varied with the contents of these nutrients in diet. The digestibility of protein was high when the diet contained relatively high levels of protein. Whereas, the digestibility of α-starch showed high value when the diet contained relatively low levels of starch. As the content of starch in diet increased, the digestibility decreased. A β-starch (raw) was considerably low in digestibility. (Authors)

6230. Carter, James P. (Dept. of Fish & Wildl. Resources, Frankfort, Kentucky). 1963. EXPERIMENTAL CRAPPIE REMOVAL. Kentucky Dept. of Fish & Wildl., Completion Report, Project F-21-R, 18 pp.

A study was conducted to determine the effectiveness of gill nets and hoop nets for crappie removal in Dewey Reservoir.

Netting success was poor, and the total harvest of crappie was below that considered necessary to significantly reduce competition within the population. Only 1,374 crappie were harvested, 4.04 per net day.

White crappie comprised the greatest percentage of the total number of fish taken in gill nets, 33.7 percent, while bluegill dominated the hoop net harvest, 49.3 percent. (Auth.)

6231. Beitch, Irwin (Dept. of Biol., Univ. of Virginia, Charlottesville). 1963. A HISTOMORPHOLOGICAL COMPARISON OF THE URINARY SYSTEMS IN THE SERRANID FISHES, ROCCUS SAXATILIS AND ROCCUS AMERICANUS. Chesapeake Science, Vol. 4, No. 2, pp. 75-83.

The urinary systems of the striped bass, Roccus saxatilis (N = 13), and white perch, R. americanus (N = 12), were studied to determine if they supported the monogeneric classification and to examine the osmoregulatory structure that may enable the species to survive in environments of different salinities.

The gross anatomy of the urinary systems of the two species showed a number of similarities, e. g. the general mesonephric form and size, ureteral position and length, and the renal venous system. The head kidney, a hemopoietic organ, was larger in R. saxatilis than in R. americanus. Histological comparisons were made of H and E serial sections of the posterior part of the kidneys, and of the ureter, from three R. saxatilis and four R. americanus; included were the entire kidneys of two 2-year-old males of each species. The kidney of a young specimen of each species was also studied. The glomeruli in R. americanus (59.7 μ) were found to be larger than those in R. saxatilis (47.7μ); in a previous study, fresh-water R. saxatilis (55.7μ) were shown to have glomeruli of intermediate size. The number of goblet cells in the anterior part of the ureter was greater in R. saxatilis (approx. 20:1) and may be correlated with glomerular size. A distal tubular segment, usually present in fresh-water fishes, was absent in both species; probably a reflection of their marine origin.

As the differences in the urinary systems were explained on the basis of phenotypic responses to the environment, they, and the number of similarities, were considered to support a monogeneric classification. (Auth.)

6232. Mar, John (Pacific Naval Lab., Esquimalt, B. C., Canada). 1959. A PROPOSED TUNNEL DESIGN FOR A FISH RESPIROMETER. Defence Research Board, Canada, Tech. Memo. 59-3, 13 pp.

This report summarizes findings of a design study of a closed-circuit water tunnel for testing the respiration rates of young sockeye and coho salmon. (Auth.)

6233. Shapiro, M. A. (Dept. of Pub. Hlth., Univ. Pittsburgh, Penna.). 1962. A LIMNOLOGICAL STUDY OF THE UPPER OHIO RIVER. Univ. of Pittsburgh, Report No. AT(30-1_-2411, 63 pp.

This is the final report concerned with the effect of radioactive waste discharge on the limnology of the upper Ohio River. Radiation and hydromechanics phases are discussed.

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